

US EPA ARCHIVE DOCUMENT

**PROPOSED
TOTAL MAXIMUM DAILY LOAD (TMDL)**

**For
Fecal Coliform**

In

C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 East (WBID 3281)

Prepared by:

US EPA Region 4
61 Forsyth Street SW
Atlanta, Georgia 30303

September 30, 2011



Acknowledgments

EPA would like to acknowledge that the contents of this report and the total maximum daily load (TMDL) contained herein were developed by the Florida Department of Environmental Protection (FDEP). Many of the text and figures may not read as though EPA is the primary author for this reason, but EPA is officially proposing the TMDLs for fecal coliform for C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 East (WBID 3281) and is soliciting comment. EPA is proposing these TMDLs in order to meet consent decree requirements pursuant to the Consent Decree entered in the case of Florida Wildlife Federation, et al. v. Carol Browner, et al., Case No. 98-356-CIV-Stafford. EPA will accept comments on these proposed TMDLs for 30 days in accordance with the public notice issued on September 30, 2011. Should EPA be unable to approve a TMDL established by FDEP for the 303(d) listed impairments addressed by this report, EPA will establish this TMDL in lieu of FDEP, after full review of public comments.

This Total Maximum Daily Load (TMDL) analysis could not have been accomplished without significant contributions from staff in the Broward County Department of Planning and Environmental Protection, FDEP's Watershed Assessment Section and Watershed Evaluation and TMDL Section. Map production assistance was provided by the Watershed Data Services Section with the FDEP's Division of Environmental Assessment and Restoration.

Editorial assistance provided by: Jan Mandrup-Poulsen and Linda Lord

For additional information on the watershed management approach and impaired waters in the Southeast Coast-Biscayne Bay Basin, contact:

John Abendroth
Florida Department of Environmental Protection
Bureau of Watershed Restoration
Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
Email: john.abendroth@dep.state.fl.us
Phone: (850) 850-245-8555
Fax: (850) 245-8434

Access to all data used in the development of this report can be obtained by contacting:

Moirá Rojas
Florida Department of Environmental Protection
Bureau of Watershed Restoration
Watershed Evaluation and TMDL Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

Email: moira.rojas@dep.state.fl.us

Phone: (850) 245-8460

Fax: (850) 245-8444

Contents

Chapter 1: INTRODUCTION.....	1
1.1 Purpose of Report	1
1.2 Identification of Waterbody.....	1
1.3 Background	5
Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM.....	10
2.1 Statutory Requirements and Rulemaking History	10
2.2 Information on Verified Impairment	10
Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS.....	12
3.1 Classification of the Waterbody and Criterion Applicable to the TMDL ..	12
3.2 Applicable Water Quality Standards and Numeric Water Quality Target ..	12
Chapter 4: ASSESSMENT OF SOURCES	13
4.1 Types of Sources	13
4.2 Potential Sources of Fecal Coliform within Boundaries of WBID 3270, WBID 3273, WBID 3274, WBID 3276, WBID 3276A, WBID 3277A, WBID 3277C, WBID 3277E, WBID 3279 and WBID 3281	13
4.2.1 Point Sources	13
Wastewater Point Sources	13
Municipal Separate Storm Sewer System Permittees	15
4.2.2 Land Uses and Nonpoint Sources	15
Land Uses	16
Urban Development	16
Boats	16
Wildlife and Sediments	16
Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY.....	20
5.1 Determination of Loading Capacity	20
5.1.1 Data Used in the Determination of the TMDL	20
Temporal Patterns	29
Spatial Patterns	64
5.1.2 Critical Condition	88
5.1.3 TMDL Development Process	109

Chapter 6: DETERMINATION OF THE TMDL.....	134
6.1 Expression and Allocation of the TMDL	134
6.2 Load Allocation	134
6.3 Wasteload Allocation.....	135
6.3.1 NPDES Wastewater Discharges	135
6.3.2 NPDES Stormwater Discharges	136
6.4 Margin of Safety	136
Chapter 7: TMDL IMPLEMENTATION	137
7.1 Basin Management Action Plan	137
7.2 Other TMDL Implementation Tools	138
References	139
Appendices	142
Appendix A: Background Information on Federal and State Stormwater Programs.....	142
Appendix B: Estimates of Fecal Coliform Loadings from Potential Sources	143
<i>Pets</i>	143
<i>Sanitary Sewer Overflows</i>	145
<i>Septic Tanks</i>	148
<i>Wildlife</i>	151
Appendix C: Municipalities Located within each WBID Boundary	152

List of Tables

Table 1.1.	Waterbody Identification (WBID) Number for Waterbodies Included in this TMDL Report.....	1
Table 1.2.	Area within each WBID Boundary in Square Miles and in Acres.....	5
Table 2.1a.	Summary of Fecal Coliform Monitoring Data for WBIDs 3274, 3276A and 3277A During the Cycle 1 Verified Period (January 1, 1998 through June 30, 2005).....	11
Table 2.1b.	Summary of Fecal Coliform Monitoring Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 During the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	11
Table 4.1.	Wastewater Point Sources: NPDES Permitted Facilities by WBID.....	14
Table 4.2.	Municipal Separate Storm Sewer System Permittees by WBID.....	15
Table 4.3.	Classification of Land Use Categories for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 in 2004-2005	18
Table 5.1.	Stations where Water Quality Samples Were Collected for Fecal Coliform Data during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	21
Table 5.2.	Descriptive Statistics of Fecal Coliform Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 for the Cycle 2 Verified Period (January 1, 2003 - June 30, 2010)	22
Table 5.3a.	Summary Statistics of Fecal Coliform Data for All Stations in WBID 3270 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	30
Table 5.3b.	Summary Statistics of Fecal Coliform Data for All Stations in WBID 3270 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	31
Table 5.3c.	Summary Statistics of Fecal Coliform Data for All Stations in WBID 3273 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	32
Table 5.3d.	Summary Statistics of Fecal Coliform Data for All Stations in WBID 3273 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	32

Table 5.3e.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3274 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	33
Table 5.3f.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3274 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	34
Table 5.3g.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	35
Table 5.3h.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	35
Table 5.3i.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	36
Table 5.3j.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276A by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	37
Table 5.3k.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	38
Table 5.3l.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277A by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	38
Table 5.3m.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277C by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	39
Table 5.3n.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277C by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	40
Table 5.3o.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277E by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	41
Table 5.3p.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277E by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	41
Table 5.3q.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3279 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	42

Table 5.3r.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3279 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>43</i>
Table 5.3s.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3281 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>44</i>
Table 5.3t.	<i>Summary Statistics of Fecal Coliform Data for All Stations in WBID 3281 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>44</i>
Table 5.4.	<i>South Florida Water Management District (SFWMD) Rainfall Stations Used to Determine Monthly and Quarterly Rainfall Data for each WBID</i>	<i>45</i>
Table 5.5a.	<i>Station Summary Statistics of Fecal Coliform Data for the C-14 (Cypress Creek) Canal (WBID 3270) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>67</i>
Table 5.5b.	<i>Station Summary Statistics of Fecal Coliform Data for the C-13 West (Middle River) Canal (WBID 3273) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	<i>69</i>
Table 5.5c.	<i>Station Summary Statistics of Fecal Coliform Data for the C-13 East (Middle River) Canal (WBID 3274) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	<i>71</i>
Table 5.5d.	<i>Station Summary Statistics of Fecal Coliform Data for the C-12 Canal (WBID 3276) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>73</i>
Table 5.5e.	<i>Station Summary Statistics of Fecal Coliform Data for the New River (North Fork) (WBID 3276A) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>75</i>
Table 5.5f.	<i>Station Summary Statistics of Fecal Coliform Data for the New River Canal (South) (WBID 3277A) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>77</i>
Table 5.5g.	<i>Station Summary Statistics of Fecal Coliform Data for the North New River Canal (WBID 3277C) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>79</i>
Table 5.5h.	<i>Station Summary Statistics of Fecal Coliform Data for the Dania Cut-off Canal (WBID 3277E) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>81</i>
Table 5.5i.	<i>Station Summary Statistics of Fecal Coliform Data for the South New River Canal (C-11) (WBID 3279) during the</i>	

	<i>Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	<i>84</i>
<i>Table 5.5j.</i>	<i>Station Summary Statistics of Fecal Coliform Data for the C-11 (East) (WBID 3281) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>86</i>
<i>Table 5.6.</i>	<i>Precipitation Event Ranges for Rainfall Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281</i>	<i>89</i>
<i>Table 5.7a.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-14 (Cypress Creek) Canal (WBID 3270).....</i>	<i>90</i>
<i>Table 5.7b.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 West (Middle River) Canal (WBID 3273).....</i>	<i>91</i>
<i>Table 5.7c.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 East (Middle River) Canal (WBID 3274).....</i>	<i>93</i>
<i>Table 5.7d.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-12 Canal (WBID 3276).....</i>	<i>95</i>
<i>Figure 5.7d.</i>	<i>Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-12 Canal (WBID 3276)</i>	<i>96</i>
<i>Table 5.7e.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the New River (North Fork) (WBID 3276A).....</i>	<i>97</i>
<i>Table 5.7f.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the New River Canal (South) (WBID 3277A).....</i>	<i>99</i>
<i>Table 5.7g.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the North New River Canal (WBID 3277C).....</i>	<i>101</i>
<i>Table 5.7h.</i>	<i>Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the Dania Cut-off Canal (WBID 3277E).....</i>	<i>103</i>

Table 5.7i.	Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the South New River Canal (C-11) (WBID 3279).....	105
Table 5.7j.	Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-11 (East) (WBID 3281).....	107
Table 5.8a.	Calculation of Fecal Coliform Reductions for the C-14 (Cypress Creek) Canal (WBID 3270) TMDL Based on the Hazen Method	111
Table 5.8b.	Calculation of Fecal Coliform Reductions for the C-13 West (Middle River) Canal (WBID 3273) TMDL Based on the Hazen Method	114
Table 5.8c.	Calculation of Fecal Coliform Reductions for the C-13 East (Middle River) Canal (WBID 3274) TMDL Based on the Hazen Method	116
Table 5.8d.	Calculation of Fecal Coliform Reductions for the C-12 Canal (WBID 3276) TMDL Based on the Hazen Method	120
Table 5.8e.	Calculation of Fecal Coliform Reductions for the New River (North Fork) (WBID 3276A) TMDL Based on the Hazen Method.....	122
Table 5.8f.	Calculation of Fecal Coliform Reductions for the South Fork New River (WBID 3277A) TMDL Based on the Hazen Method.....	124
Table 5.8g.	Calculation of Fecal Coliform Reductions for the North New River Canal (WBID 3277C) TMDL Based on the Hazen Method.....	127
Table 5.8h.	Calculation of Fecal Coliform Reductions for the Dania Cut-off Canal (WBID 3277E) TMDL Based on the Hazen Method.....	129
Table 5.8i.	Calculation of Fecal Coliform Reductions for the South New River Canal (C-11) (WBID 3279) TMDL Based on the Hazen Method	131
Table 5.8j.	Calculation of Fecal Coliform Reductions for the C-11 East (South New River) Canal (WBID 3281) TMDL Based on the Hazen Method	133
Table 6.1.	TMDL Components for Fecal Coliform in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281.....	135
Table B.1.	Estimated Number of Households and Dogs, Waste Produced (grams/day) by Dogs Left on the Land Surface	

	<i>and Total Load of Fecal Coliform (counts/day) Produced by Dogs within each WBID Boundary</i>	<i>144</i>
Table B.2.	<i>Dog Population Density, Wasteload and Fecal Coliform Density Based on the Literature (Weiskel et al., 1996).....</i>	<i>144</i>
Table B.3.	<i>Estimated Number of Households Served by Sanitary Sewers and Estimated Fecal Coliform Loading from Sewer Line Leakage within each WBID Boundary</i>	<i>146</i>
Table B.4.	<i>Estimated Number of Households Using Septic Tanks and Estimated Septic Tank Loading within each WBID Boundary.....</i>	<i>150</i>
Table C.1.	<i>Municipalities and Municipal Separate Storm Sewer System Permittees by WBID</i>	<i>152</i>

List of Figures

Figure 1.1.	Location of the C-14 (Cypress Creek) Canal (WBID 3270), C-13 West (Middle River) Canal (WBID 3273), C-13 East (Middle River) Canal (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River Canal (WBID 3277C), Dania Cut-off Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 (East) (WBID 3281) in the Southeast Coast-Biscayne Bay Basin and Major Hydrologic and Geopolitical Features in the Area.....	7
Figure 1.2.	Location of the C-14 (Cypress Creek) Canal (WBID 3270), C-13 West (Middle River) Canal (WBID 3273), C-13 East (Middle River) Canal (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River Canal (WBID 3277C), Dania Cut-off Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 (East) (WBID 3281) in the Southeast Coast-Biscayne Bay Basin and Major Hydrologic and Geopolitical Features in the Area.....	8
Figure 1.3.	Location of Canals, Water Conservation Areas and Water Control Structures in Broward County (from SFWMD, 2010)	9
Figure 4.1.	Principal Land Uses within Boundaries of WBID 3270, WBID 3273, WBID 3274, WBID 3276, WBID 3276A, WBID 3277A, WBID 3277C, WBID 3277E, WBID 3279 and WBID 3281 in 2004-2005	19
Figure 5.1.	Location of Water Quality Stations with Fecal Coliform Data in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281	23
Figure 5.2a.	Fecal Coliform Concentrations over Time in the C-14 (Cypress Creek) Canal (WBID 3270) for the Cycle 2 Verified Period	24
Figure 5.2b.	Fecal Coliform Concentrations over Time in the C-13 West (Middle River) Canal (WBID 3273) for the Cycle 2 Verified Period	25
Figure 5.2c.	Fecal Coliform Concentrations over Time in the C-13 East (Middle River) Canal (WBID 3274) for the Cycle 2 Verified Period	25
Figure 5.2d.	Fecal Coliform Concentrations over Time in the C-12 Canal (WBID 3276) for the Cycle 2 Verified Period	26
Figure 5.2e.	Fecal Coliform Concentrations over Time in the New River (North Fork) (WBID 3276A) for the Cycle 2 Verified Period.....	26

Figure 5.2f.	<i>Fecal Coliform Concentrations over Time in the New River Canal (South) (WBID 3277A) for the Cycle 2 Verified Period</i>	<i>27</i>
Figure 5.2g.	<i>Fecal Coliform Concentrations over Time in the North New River Canal (WBID 3277C) for the Cycle 2 Verified Period.....</i>	<i>27</i>
Figure 5.2h.	<i>Fecal Coliform Concentrations over Time in the Dania Cut-off Canal (WBID 3277E) for the Cycle 2 Verified Period</i>	<i>28</i>
Figure 5.2i.	<i>Fecal Coliform Concentrations over Time in the South New River Canal (C-11) (WBID 3279) for the Cycle 2 Verified Period</i>	<i>28</i>
Figure 5.2j.	<i>Fecal Coliform Concentrations over Time in the C-11 (East) (WBID 3281) for the Cycle 2 Verified Period.....</i>	<i>29</i>
Figure 5.3a.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3270 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>46</i>
Figure 5.3b.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3270 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>46</i>
Figure 5.3c.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3273 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>47</i>
Figure 5.3d.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3273 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>48</i>
Figure 5.3e.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3274 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>49</i>
Figure 5.3f.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3274 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>49</i>
Figure 5.3g.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>50</i>
Figure 5.3h.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>51</i>
Figure 5.3i.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>51</i>
Figure 5.3j.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276A by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>52</i>

Figure 5.3k.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>53</i>
Figure 5.3l.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277A by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>53</i>
Figure 5.3m.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277C by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>54</i>
Figure 5.3n.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277C by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>54</i>
Figure 5.3o.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277E by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>55</i>
Figure 5.3p.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277E by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>55</i>
Figure 5.3q.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3279 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>56</i>
Figure 5.3r.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3279 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>56</i>
Figure 5.3s.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3281 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>57</i>
Figure 5.3t.	<i>Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3281 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>57</i>
Figure 5.4a.	<i>Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) for the Entire Period of Record (1972 – 2010)</i>	<i>59</i>
Figure 5.4b.	<i>Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) for the Entire Period of Record (1972 – 2010).....</i>	<i>60</i>
Figure 5.4c.	<i>Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) for the Entire Period of Record (1972 – 2010).....</i>	<i>60</i>
Figure 5.4d.	<i>Fecal Coliform Concentration Trends in the C-12 Canal (WBID 3276) for the Entire Period of Record (1972 – 2010)</i>	<i>61</i>

Figure 5.4e.	<i>Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) for the Entire Period of Record (1972 – 2010)</i>	61
Figure 5.4f.	<i>Fecal Coliform Concentration Trends in the South Fork New River (WBID 3277A) for the Entire Period of Record (1972 – 2010)</i>	62
Figure 5.4g.	<i>Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) for the Entire Period of Record (1973 – 2010)</i>	62
Figure 5.4h.	<i>Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) for the Entire Period of Record (1973 – 2010)</i>	63
Figure 5.4i.	<i>Fecal Coliform Concentration Trends in the South New River Canal (C-11) (WBID 3279) for the Entire Period of Record (1972 – 2010)</i>	63
Figure 5.4j.	<i>Fecal Coliform Concentration Trends in the C-11 East (South New River) Canal (WBID 3281) for the Entire Period of Record (1972 – 2010)</i>	64
Figure 5.5a.	<i>Spatial Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	65
Figure 5.5b.	<i>Spatial Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	66
Figure 5.5c.	<i>Spatial Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	68
Figure 5.5c.	<i>Spatial Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	69
Figure 5.5e.	<i>Spatial Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	70
Figure 5.5f.	<i>Spatial Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	71

Figure 5.5g.	<i>Spatial Fecal Coliform Concentration Trends in the C-12 Canal (WBID 3276) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>72</i>
Figure 5.5h.	<i>Spatial Fecal Coliform Concentration Trends in the C-12 Canal (WBID 3276) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>73</i>
Figure 5.5i.	<i>Spatial Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	<i>74</i>
Figure 5.5j.	<i>Spatial Fecal Coliform Concentration Trends in New River (North Fork) (WBID 3276A) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>75</i>
Figure 5.5k.	<i>Spatial Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	<i>76</i>
Figure 5.5l.	<i>Spatial Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>77</i>
Figure 5.5m.	<i>Spatial Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>78</i>
Figure 5.5n.	<i>Spatial Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>79</i>
Figure 5.5o.	<i>Spatial Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>80</i>
Figure 5.5p.	<i>Spatial Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>81</i>
Figure 5.5q.	<i>Spatial Fecal Coliform Concentration Trends in South New River Canal (C-11) (WBID 3279) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....</i>	<i>82</i>
Figure 5.5r.	<i>Spatial Fecal Coliform Concentration Trends in the South New River Canal (C-11) (WBID 3279) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)</i>	<i>83</i>

Figure 5.5s. Spatial Fecal Coliform Concentration Trends in the C-11 (East) (WBID 3281) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	85
Figure 5.5t. Spatial Fecal Coliform Concentration Trends in the C-11 (East) (WBID 3281) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010).....	86
Figure 5.6. Principal Land Uses and Location of Water Quality Stations with Fecal Coliform Data in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281.....	87
Figure 5.7a. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-14 (Cypress Creek) Canal (WBID 3270).....	90
Figure 5.7b. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 West (Middle River) Canal (WBID 3273)	92
Figure 5.7c. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 East (Middle River) Canal (WBID 3274)	94
Figure 5.7e. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the New River (North Fork) (WBID 3276A)	98
Figure 5.7f. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the South Fork New River (WBID 3277A).....	100
Figure 5.7g. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the North New River Canal (WBID 3277C).....	102
Figure 5.7h. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the Dania Cut-off Canal (WBID 3277E)	104
Figure 5.7i. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the South New River Canal (C-11) (WBID 3279)	106
Figure 5.7j. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-11 East (South New River) Canal (WBID 3281)	108

Figure B.1.	<i>Distribution of Onsite Sewage Disposal Systems (Septic Tanks) within the C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cutoff Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 East (WBID 3281) WBID Boundaries</i>	147
Figure C.1a.	<i>Municipalities/Permittees within the C-14 (Cypress Creek) Canal (WBID 3270) Boundary</i>	154
Figure C.1b.	<i>Municipalities/Permittees within the C-13 West (Middle River) Canal (WBID 3273) Boundary</i>	155
Figure C.1c.	<i>Municipalities/Permittees within the C-13 East (Middle River) Canal (WBID 3274) Boundary</i>	156
Figure C.1d.	<i>Municipalities/Permittees within the C-12 Canal (WBID 3276) Boundary</i>	157
Figure C.1e.	<i>Municipalities/Permittees within the New River (North Fork) (WBID 3276A) Boundary</i>	158
Figure C.1f.	<i>Municipalities within the New River Canal (South) (WBID 3277A) Boundary</i>	160
Figure C.1g.	<i>Municipalities/Permittees within the North New River Canal (WBID 3277C) Boundary</i>	162
Figure C.1h.	<i>Municipalities/Permittees within the Dania Cut-off Canal (WBID 3277E) Boundary</i>	163
Figure C.1i.	<i>Municipalities/Permittees within the South New River Canal (C-11) (WBID 3279) Boundary</i>	164
Figure C.1j.	<i>Municipalities within the C-11 (East) (WBID 3281) Boundary</i>	165

Websites

Florida Department of Environmental Protection, Bureau of Watershed Restoration

TMDL Program

<http://www.dep.state.fl.us/water/tmdl/index.htm>

Identification of Impaired Surface Waters Rule

<http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf>

Florida STORET Program

<http://www.dep.state.fl.us/water/storet/index.htm>

2010 Integrated Report

http://www.dep.state.fl.us/water/docs/2010_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

<http://www.dep.state.fl.us/water/wqssp/classes.htm>

Basin Status Report: Biscayne Bay – Southeast Coast

<http://tlhdwf2.dep.state.fl.us/basin411/southeast/status/BB-SECoast.pdf>

Water Quality Assessment Report: Biscayne Bay – Southeast Coast

<http://tlhdwf2.dep.state.fl.us/basin411/southeast/assessment/BB-SECoast.pdf>

U.S. Environmental Protection Agency

Region 4: TMDLs in Florida

<http://www.epa.gov/region4/water/tmdl/florida/>

National STORET Program

<http://www.epa.gov/storet/>

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal coliform bacteria for the C-14 (Cypress Creek) Canal, C-13 West (Middle River) Canal, C-13 East (Middle River) Canal, C-12, New River (North Fork), New River Canal (South), North New River Canal, Dania Cut-off Canal, South New River Canal (C-11), and C-11 (East), located in the Southeast Coast-Biscayne Bay Basin. These systems were verified as impaired for fecal coliform, and therefore were included on the Verified Lists of impaired waters for the Southeast Coast-Biscayne Bay Basin that were adopted by Secretarial Order in May, 2006 or November, 2010. These TMDLs establish allowable fecal coliform loadings to these water segments that would restore the waterbodies so that they meet their applicable water quality criteria for fecal coliform.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (Department) has divided the Southeast Coast-Biscayne Bay Basin into water assessment polygons with a unique **waterbody identification** (WBID) number for each watershed or stream reach. The WBID numbers for the waterbodies addressed in this report are presented in **Table 1.1**.

Table 1.1. Waterbody Identification (WBID) Number for Waterbodies Included in this TMDL Report

This is a two-column table. Column 1 lists the WBID number, and Column 2 lists the water segment name

WBID	Water Segment Name
3270	C-14 (Cypress Creek) Canal
3273	C-13 West (Middle River) Canal
3274	C-13 East (Middle River) Canal
3276	C-12
3276A	New River (North Fork)
3277A	New River Canal (South)
3277C	North New River Canal
3277E	Dania Cut-off Canal
3279	New River Canal (South)
3281	C-11 (East)

These waterbodies are ten of the 22 waterbody segments in the Southeast Coast-Biscayne Bay Basin, Broward County Planning Unit. WBIDs 3270, 3273, 3276, 3277A, 3279 and 3281 are six of 19 waterbody segments in the Southeast Coast-Biscayne Bay Basin included on the initial 1998 303(d) list submitted by the Department to the U.S. Environmental Protection Agency (EPA). The initial 1998 303(d) list was incorporated into a 1999 Consent Decree between EPA and Earth Justice.

The initial list used data from stations listed in the Department's 1996 305(b) report. The report used best available information at the time to generally characterize the quality of Florida's waters. Some of the delineations of waterbody areas and locations of sampling stations for the 1998 303(d) list were inaccurate due to metadata limitations at that time. With the primary goal of providing more accurate assessments, the Department has revised the delineations over time. EPA has labeled the redrawing of WBID boundaries "resegmentation," as the original stations corresponded to specific WBID areas or segments. Resegmented WBIDs are those WBIDs that have been altered from the initial 1998 303(d) Consent Decree or previous cycle boundaries. As a result of the resegmentation process for the Group 4 Basins, there are currently 37 Consent Decree waterbody segments in the Southeast Coast-Biscayne Bay Basin, including WBIDs 3274, 3276A, 3277C and 3277E. This number is based on IWR Run 41x.

The WBIDs addressed in these TMDLs are located within Broward County (**Figures 1.1 and 1.2**). Broward County is comprised of a highly engineered and managed complex system of canals. As a result, hydrology within the county is highly manipulated by a series of water control structures, pumps and levees that have altered the natural hydroperiods and flows of these watersheds (BCDPEP, 2001a), and have resulted in effective management of water in the region allowing for the current urban development and agricultural landscape (SFWMD, 2010).

The primary drainage system in the County, managed by the South Florida Water Management District (SFWMD), includes nine major canals and their drainage basins: Hillsboro Canal, C-14 (Cypress Creek) Canal, Pompano Canal, C-13 (Middle River) Canal, C-12 (Plantation) Canal, North New River Canal, C-11 (South New River) Canal, C-9 (Snake Creek) Canal, and the C-10. With the exception of the western segment of the C-11, which is normally back-pumped into Water Conservation Areas (WCAs), these major canals, along with secondary and tertiary canals, eventually drain to estuarine waters (BCDPEP, 2001a) (**Figure 1.3**).

These canals were built to meet population needs by controlling water levels and movement for water supply, flood control, drainage and navigation, in addition to providing water necessary to maintain natural communities in lakes, wetlands, rivers and estuaries (SFWMD, 2010). Water levels are managed to maintain ground water control during dry periods, particularly important for water supply needs by preventing saltwater intrusion. During dry periods, stored water can be delivered throughout the county to help meet local urban and agricultural needs and prevent saltwater intrusion. During wet periods, canals function to remove excess water from drainage basins to prevent flooding.

Within urban areas, canals are used primarily for flood control. However, secondary uses include drainage of land for development, wellfield recharge for local municipalities and discharge of excess water to and from the Water Conservation Areas (WCAs) of the Everglades (Cooper and Lane 1987), with primary canals functioning as an outlet for excess water from the Everglades and Lake Okeechobee during wet periods.

All canal segments contain either a water control structure within them or are directly influenced by the operation of an upstream or downstream control structure (SFWMD, 2010) (**Figure 1.3**). Structures regulate the flow and level of water in these canals. Coastal structures also prevent salt water from a tidal or storm surge from entering canals that discharge to tide.

Canals are notably different from most natural waterbodies. As a result of their design, management and maintenance, these systems provide limiting environmental conditions for aquatic life. In addition, water levels and flow are exposed to extreme fluctuations; canals are designed to move high flows accompanied with high velocities. Depending on operational needs, water flow through a canal may be as if in a stream or as if in a reservoir. During periods of drought and dry season operations, canals may be stagnant for extended periods and some may have little or no water (SFWMD, 2010).

The C-14 (Cypress Creek) Canal (WBID 3270) is located in northern Broward County. The western portion of this basin was designed for a 1 in 10-year flood protection and the eastern portion of the basin for a 1 in 30-year flood protection (SFWMD, 2010). In addition to flood protection, the C-14 canal and water control structures associated with it supply water, maintain the water table, transport excess water from the WCA-2A to tidewater, and intercept and control seepage from the WCA-2A (SFWMD, 2010). Although, in general, water flow in the C-14 Canal is to the eastern estuarine waters from the WCA-2A, the S-37B structure can act as a separator based on specific hydrological conditions (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

The C-13 (Middle River) Canal is located in north-central Broward County. The C-13 basin is divided into an eastern basin (WBID 3274) and a western basin (WBID 3273). The western basin includes the entire freshwater section of the C-13 Canal. In general, water flow is from the confluence of the C-42 to the eastern estuarine waters via the S-36 water control structure (BCDPEP, 2001a). The canals and associated water control structures in the C-13 basin provide flood protection, drainage, supply water, they intercept and control seepage from WCA-2B, and maintain a ground water table elevation west of the S-36 to prevent saltwater intrusion (SFWMD, 2010) (**Figure 1.2 and Figure 1.3**).

The C-12 (WBID 3276) is located in east-central Broward County. The main function of this canal and its associated water control structure is to provide flood protection, drainage, and to maintain ground water levels west of S-33 (SFWMD, 2010). The C-12 is the headwaters of the North Fork of the New River. Unlike other canals in Broward County, the C-12 canal has no direct or indirect connection to seepage water from the WCAs; water supply in the basin is limited to rainfall. Studies conducted in the basin have determined that the basin is stagnant (no flow occurs) 85% of the time at the structure (S-33) (BCDPEP, 2001a). As a result, this canal is considered a “closed” water body, receiving inputs mainly from ground water and stormwater based on rainfall patterns (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

The New River Basin is located in east-central Broward County. The basin is characterized by three distinct areas - the main New River, and its South Fork (WBID 3277A) and North Fork (WBID 3276A). The New River basin is one of two large estuarine reaches in Broward County, the other being the Intercoastal Waterway (ICW) (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

The North Fork is a shallow, meandering tributary of the New River, with minimal tidal flow and limited exchanges of tidal waters (BCDPEP, 2001b). Most of the North Forks' freshwater input is stormwater, with seasonal ground water contributions (BCDPEP, 2001a). The South Fork (WBID 3277A), made up of two freshwater tributaries, the C-11 and the North New River Canal, has a relatively dynamic, high flow rate and does not consistently receive flow from C-12 canal discharges. As a result, the North Fork (WBID 3276A) functions mainly as a tidal "pond" characterized by stagnant waters with restricted outflow to the main New River (BCDPEP, 2001a). The southwestern portion of the South Fork includes a large natural area (Pond Apple Slough), as well as other widespread vegetated areas (Griffey Tract) which contain large areas of mangrove forests and leatherfern stands (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

The North New River Canal basin (WBID 3277C) is located in east-central Broward County. The North New River was excavated and extended to drain the Everglades, and to provide a transportation route between Lake Okeechobee and the east coast (SFWMD, 2010). This canal flows to the southeast with discharge to the South Fork of the New River east of the G-54 lock (SFWMD, 2010). The freshwater portion of the North New River Canal is a bordering waterway from the WCA tailwaters to an estuarine discharge point at G-54 (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

C-11 (South New River) Canal is located in southwest Broward County and is divided into a western (WBID 3279) and an eastern basin (WBID 3281). The C-11 extends from the L-37 borrow canal on the west to S-13 water control structure. The flow in the eastern portion of the canal moves to the east discharging to the South Fork of the New River. Any excess water in the eastern basin is discharged to the east by the C-11 and S-13 to the South Fork of the New River. Additional discharges of excess water from the western basin can be made to the eastern basin through S-13A water control structure if the S-13 is not pumping to capacity (SFWMD, 2010). The western segment of the C-11 is normally back-pumped into the WCAs (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

The Dania Cut-off Canal (WBID 3277E) is located in the southeast corner of Broward County. Freshwater in the canal originates mainly from the C-11 Canal to the west (upstream) of the Dania Cut-off Canal and is controlled by releases through the S-13 water control structure. It flows east to join the ICW just south of Port Everglades. Tidewater primarily comes from the Port Everglades Inlet, with some tidal interaction also occurring with the South Fork of the New River in the western portion of the Dania Cut-off Canal (BCDPEP, 2001a) (**Figure 1.2 and Figure 1.3**).

The area, in square miles and acres, within each WBID boundary is presented in **Table 1.2**; the WBIDs are predominantly medium- and high-density residential. Additional information about the hydrology and geology of this area is available in the *Broward County, Florida Historical Water Quality Atlas: 1972-1997, Technical Report, TR 01-03*, by the Broward County Department of Planning and Environmental Protection (BCDPEP, 2001a).

Table 1.2. Area within each WBID Boundary in Square Miles and in Acres

This is a four-column table. Column 1 lists WBID number, Column 2 lists the waterbody name parameter, Column 3 lists the WBID area in square miles, and Column 4 lists the WBID area in acres.

WBID	Waterbody	WBID Area	
		Square Miles	Acres
3270	C-14 (Cypress Creek) Canal	56.1	35,884
3273	C-13 West (Middle River) Canal	20.6	13,188
3274	C-13 East (Middle River) Canal	15.2	9,723
3276	C-12	8.8	5,621
3276A	New River (North Fork)	7.1	4,523
3277A	New River Canal (South)	16.1	10,281
3277C	North New River Canal	8.7	5,555
3277E	Dania Cut-off Canal	7.4	4,719
3279	South New River Canal (C-11)	70.9	45,367
3281	C-11 (East)	22.8	14,623

WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 are located in the Atlantic Coastal Ridge and Everglades physiographic region, which occupy the eastern portions of Broward, Miami-Dade and Palm Beach Counties. In Broward County, the ridge is composed of both sand and limestone (Schroeder et al., 1956). The Everglades, an area of organic soils, is located west of the ridge and is dedicated primarily to agriculture and conservation areas (Schroeder et al., 1956).

This part of Southeastern Florida is underlain by the Biscayne Aquifer, an unconfined and shallow part of the surficial aquifer system that consists of highly permeable limestone and less-permeable sandstone and sand (Fish, 1988). The aquifer supplies large quantities of water for municipal, industrial, and irrigational use in Broward County. The Biscayne Aquifer is particularly susceptible to contamination because it is unconfined, highly permeable, and shallow, and because it is located near the surface in highly urbanized areas (Whitman, 1997). Potential sources of contamination include saltwater encroachment and infiltration of contaminants carried in canal water, direct infiltration of contaminants (chemicals or pesticides applied to or spilled on the land, fertilizer carried in surface runoff), landfills, septic tanks, sewage-plant treatment ponds, and wells used to dispose of stormwater runoff or industrial waste (Miller, 1990).

1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates

through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program—related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Section 403.067. Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a restoration plan designed to reduce the amount of fecal coliform that caused the verified impairment of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281. These activities will depend heavily on the active participation of the South Florida Water Management District (SFWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

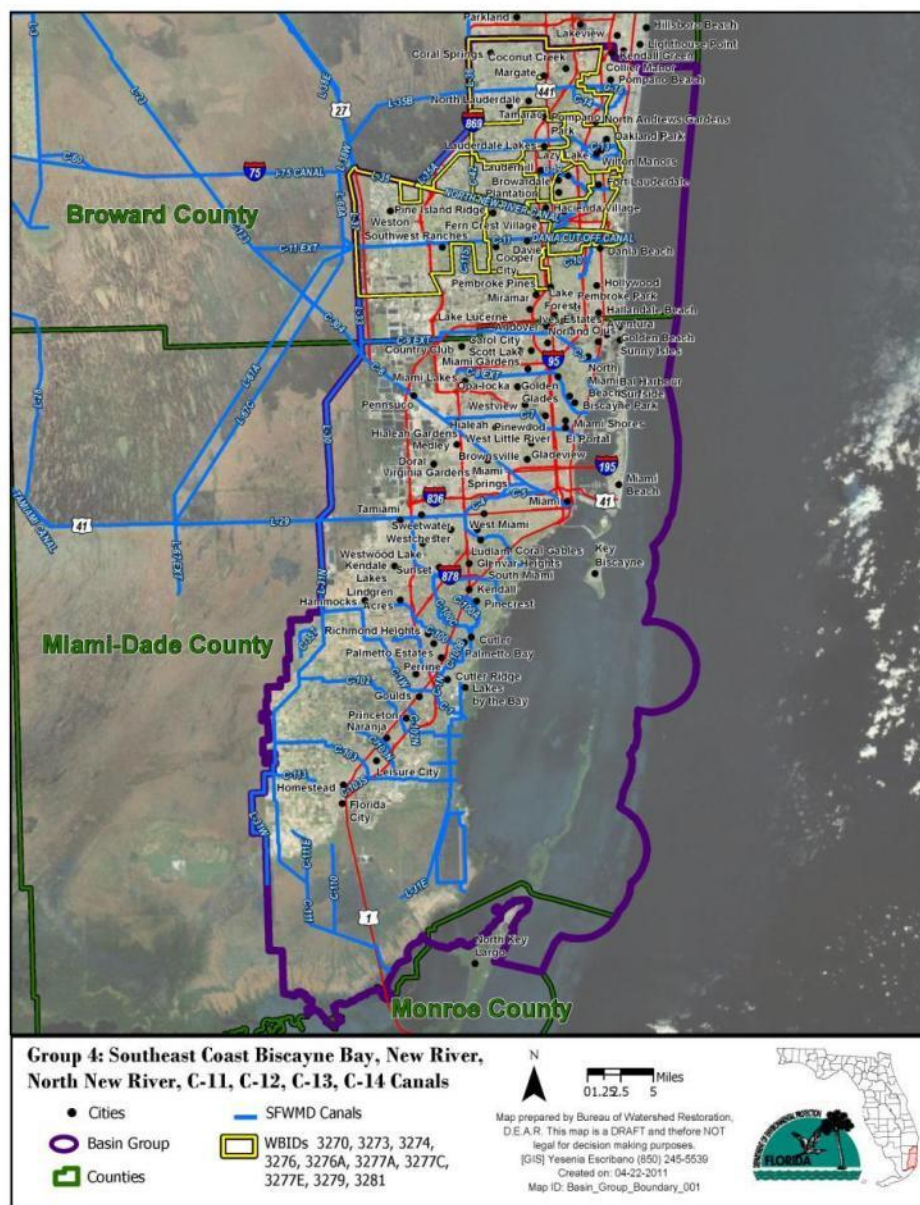


Figure 1.1. Location of the C-14 (Cypress Creek) Canal (WBID 3270), C-13 West (Middle River) Canal (WBID 3273), C-13 East (Middle River) Canal (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River Canal (WBID 3277C), Dania Cut-off Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 (East) (WBID 3281) in the Southeast Coast-Biscayne Bay Basin and Major Hydrologic and Geopolitical Features in the Area



Figure 1.2. Location of the C-14 (Cypress Creek) Canal (WBID 3270), C-13 West (Middle River) Canal (WBID 3273), C-13 East (Middle River) Canal (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River Canal (WBID 3277C), Dania Cut-off Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 (East) (WBID 3281) in the Southeast Coast-Biscayne Bay Basin and Major Hydrologic and Geopolitical Features in the Area



US EPA ARCHIVE DOCUMENT

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]); the state's 303(d) list is amended annually to include basin updates.

Florida identified 19 impaired waterbodies in the Southeast Coast-Biscayne Bay Basin on its initial 1998 303(d) list. As a result of the resegmentation process for the Group 4 Basins, there are currently 37 Consent Decree waterbody segments in the Southeast Coast-Biscayne Bay Basin (see **Section 1.2**). However, the FWRA (Section 403.067, F.S.) stated that all Florida 303(d) lists created before the adoption of the FWRA were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 and has verified that these waterbody segments are impaired for fecal coliform bacteria. Verified impairment was based on the observation that, with a 90 percent confidence limit based on binomial distribution, more than 10 percent of the values exceeded the assessment threshold of 400 counts per 100 milliliters (counts/100mL) (see **Section 3.2** for details) in all these WBIDs.

WBIDs 3274, 3276A and 3277A were verified as impaired during the Cycle 1 verified period (January 1, 1998 through June 30, 2005). These impairments were confirmed in the Cycle 2 assessment verified period (January 1, 2003, through June 30, 2010). WBIDs 3270, 3273, 3276, 3277C, 3277E, 3279 and 3281 were verified as impaired during the Cycle 2 verified period.

Tables 2.1a summarizes fecal coliform monitoring results used for verified impairment for the Cycle 1 verified period for WBIDs 3274, 3276A and 3277A. **Table 2.1b** summarizes fecal monitoring results used for verified impairment for the Cycle 2 assessment (based on IWR Run41x) for all WBIDs. As they better represent the current conditions, only the results for the Cycle 2 verified period were used in the TMDL development process.

Table 2.1a. Summary of Fecal Coliform Monitoring Data for WBIDs 3274, 3276A and 3277A During the Cycle 1 Verified Period (January 1, 1998 through June 30, 2005)

This is a four-column table. Column 1 lists the parameter, Column 2-4 list the WBID number and corresponding Cycle 1 results.

- = Empty cell/no data

Parameter	WBID		
	3274	3276A	3277A
Total number of samples	205	104	144
IWR-required number of exceedances for the Verified List	27	15	20
Number of observed exceedances	39	45	22
Number of observed nonexceedances	166	59	122
Number of seasons during which samples were collected	4	4	4

Table 2.1b. Summary of Fecal Coliform Monitoring Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 During the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eleven-column table. Column 1 lists the parameter, Column 2-11 list the WBID number and corresponding Cycle 2 results.

Parameter	WBID									
	3270	3273	3276	3279	3281	3277C	3277E	3274	3276A	3277A
Total number of samples	144	70	57	74	30	84	67	153	53	111
IWR-required number of exceedances for the Verified List	20	11	10	12	6	13	11	21	9	16
Number of observed exceedances	23	11	13	21	14	16	18	50	39	30
Number of observed nonexceedances	121	59	44	53	16	68	49	103	14	81
Number of seasons during which samples were collected	4	4	4	4	4	4	4	4	4	4
Highest observation (counts/100mL)	5,200	2,600	7,400	9,800	9,100	5,800	9,400	9,600	10,000	6,400
Lowest observation (counts/100mL)	1.8	1.8	6	1.8	44	1.8	1.8	1	150	7
Median observation (counts/100mL)	110	69	94	205	400	98	250	244	630	220
Mean observation (counts/100mL)	282	226	570	510	1,415	288	823	570	1,734	675

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	Potable water supplies
Class II	Shellfish propagation or harvesting
Class III	Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use (there are no state waters currently in this class)

All WBIDs addressed in this report are Class III waterbodies, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. WBIDs 3274, 3276A, 3277A and 3277E are Class III marine waterbodies and WBIDs 3270, 3273, 3276, 3277C, 3279 and 3281 are Class III freshwater waterbodies. The criterion applicable to these TMDLs is the Class III waters (marine and freshwater) criterion for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentration. The water quality criterion for the protection of Class III waters (marine and freshwater), as established by Rule 62-302, F.A.C., states the following:

Fecal Coliform Bacteria:

The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. There were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for these TMDLs was not to exceed 400 counts/100mL for fecal coliform.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the impaired waterbody and the amount of pollutant loadings contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term “point sources” has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA’s National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, such as those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term “point source” will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) *and* stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Fecal Coliform within Boundaries of WBID 3270, WBID 3273, WBID 3274, WBID 3276, WBID 3276A, WBID 3277A, WBID 3277C, WBID 3277E, WBID 3279 and WBID 3281

4.2.1 Point Sources

Wastewater Point Sources

Table 4.1 lists all NPDES-permitted facilities located in each WBID addressed in this report. Four of the NPDES permitted facilities within these WBIDs are listed in the Wastewater Facility Regulation (WAFR) database as surface water discharge facilities (permit numbers FL0031771, FL0040541, FLS267562, and FL0001503). Two of these facilities (permits FL0031771 and FL0040541) are Domestic Wastewater facilities; however, treated wastewater from both facilities is transported to the Atlantic Ocean via ocean outfalls and therefore, would not contribute to observed levels of fecal coliform bacteria within the WBID they are located.

The remaining two surface water discharge facilities (permits FLS267562, FL0001503) are not considered to contribute to observed levels of fecal coliform bacteria.

Due to the nature of this facility, the Pompano Harness Track (permit FLA667714) could potentially contribute to fecal coliform discharges; however, all manure/bedding in the facility is covered/contained within the production area and the horse washing is conducted over the grassy areas, as a result no wastewater/runoff is generated that is disposed of or re-used.

Table 4.1. Wastewater Point Sources: NPDES Permitted Facilities by WBID

This is a four-column table. Column 1 lists the WBIDs being impacted by point sources, Column 2 lists the facility permit number, Column 3 lists the facility name and Column 4 lists the type of facility.

WBID	Permit ID	Facility Name	Type of facility
3270	FLA667714	Pompano Harness Track	Concentrated Animal Feeding Operation
	FLG110351	CEMEX Construction Materials Florida LLC	Concrete Batch General Permit (GP)
	FLG110380	Modern Concrete Products Inc - Ft Lauderdale Plant	Concrete Batch General Permit (GP)
	FL0031771	Broward County North Regional WWTP	Domestic WWTP
	FLG110691	CEMEX LLC - Sunrise Plant	Concrete Batch General Permit (GP)
3277A	FLG110571	Tarmac America - Ft Lauderdale Plant	Concrete Batch General Permit (GP)
	FLG110693	CEMEX LLC - S Ft Lauderdale Plant	Concrete Batch General Permit (GP)
	FLS267562	Wheelabrator South Broward, Inc - Resource Recovery Facility	Individual Stormwater
3277E	FL0001503	FPL - Lauderdale Power Plant	Industrial Wastewater
3279	FLG110155	Continental FL Matl - Pembroke Pines	Concrete Batch General Permit (GP)
	FLG110332	CEMEX LLC - Pembroke Pines Plant	Concrete Batch General Permit (GP)
3281	FLG110348	Davie Concrete Corp - Davie CBP Plant	Concrete Batch General Permit (GP)
	FLG110360	Banaszak Concrete - Davie Batch Plant	Concrete Batch General Permit (GP)
	FLG110615	Continental FL Matl - Davie (E Broward)	Concrete Batch General Permit (GP)
	FL0040541	Davie, Town of - WWTP	Domestic WWTP

Municipal Separate Storm Sewer System Permittees

Table 4.2 lists all NPDES municipal separate storm sewer system (MS4) permits covering WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281. In addition, **Table 4.2** lists whether the permit includes joint participation with the Florida Department of Transportation (FDOT) within the WBID. See **Appendix C** for a list and maps of municipalities/permittees within each WBID boundary.

Table 4.2. Municipal Separate Storm Sewer System Permittees by WBID

This is a four-column table. Column 1 lists the WBID number, Column 2 lists the permit number, Column 3 lists the permit name and Column 4 lists whether the permit includes joint participation with FDOT.

- = Empty cell/no data
Y= FDOT is a co-permittee

WBID	Permit ID	Permit Name	FDOT
3270	FLS000016	Broward County and Co-Permittees	Y
	FLS000017	City of Ft. Lauderdale	-
3273	FLS000016	Broward County and Co-Permittees	Y
	FLS000017	City of Ft. Lauderdale	-
3274	FLS000016	Broward County and Co-Permittees	Y
	FLS000017	City of Ft. Lauderdale	-
3276	FLS000016	Broward County and Co-Permittees	Y
	FLS000017	City of Ft. Lauderdale	-
3279	FLS000016	Broward County and Co-Permittees	Y
3281	FLS000016	Broward County	Y
	FLS000020	City of Hollywood	-
3276A	FLS000016	Broward County and Co-Permittees	Y
	FLS000017	City of Ft. Lauderdale	-
3277A	FLS000016	Broward County and Co-Permittees	Y
	FLS000017	City of Ft. Lauderdale	-
3277C	FLS000016	Broward County and Co-Permittees	Y
3277E	FLS000016	Broward County and Co-Permittees	Y
	FLS000020	City of Hollywood	-

4.2.2 Land Uses and Nonpoint Sources

Accurately quantifying the fecal coliform loadings from nonpoint sources requires identifying nonpoint source categories, locating the sources, determining the intensity and frequency at which these sources create high fecal coliform loadings, and specifying the relative contributions from these sources. Depending on the land use distribution in a given watershed, frequently cited nonpoint sources in urban areas include failed septic tanks, leaking sewer lines, and pet feces.

In addition to the sources associated with anthropogenic activities, birds and other wildlife can also act as fecal coliform contributors to receiving waters. While detailed source information is not always available for accurately quantifying the fecal coliform loadings from different sources,

land use information can provide some hints on the potential sources of observed fecal coliform impairment.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SFWMD's 2004-2005 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories within the WBID boundary for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 were aggregated using the Florida Land Use Code and Classification System (FLUCCS) expanded Level 1 codes (including low, medium, and high density residential) and tabulated in **Table 4.3**. **Table 4.3** also shows the total area within each WBID. **Figure 4.1** shows the spatial distribution of the principal land uses within the WBID boundary.

Within all WBID boundaries, the dominant land use categories are residential (low-, medium- and high-density) and urban built-up (commercial and services, industrial, institutional, and recreational). These land uses account for approximately 58% to 91% of the total acreage for each WBID. Low impact land use areas, including rangeland, upland forest, water, wetlands, and barren lands, make up from 2% to 28% of the total areas in each WBID. Areas covered by agricultural lands are relatively small in these WBIDs, accounting from 0% to about 7% of the area.

Urban Development

Given that the dominant land use categories contributing to nonpoint source pollution are urban land areas – urban and built-up (commercial and services); medium- and high-density residential – possible sources for fecal coliform loadings can include failed septic tanks, sewer line leakage, and pet feces. A preliminary quantification of the fecal coliform loadings from these sources was conducted to demonstrate the relative contributions. **Appendix B** provides detailed load estimates and describes the methods used for the quantification. It should be noted that the information included in **Appendix B** was only used to demonstrate the possible relative contributions from different sources. These loading estimates were not used in establishing the final TMDLs.

Boats

Live-aboard vessels have been identified in areas of the North Fork New River (WBID 3276A) (Solo-Gabriele et al., 2002) and in the Port Dania Beach marina (BCDPEP, 2001a). A potentially important source of fecal coliform loading in these areas may include boat sewage discharges. In areas with high boating densities and low hydrologic flushing, boats can be a significant source of fecal coliform bacteria (USEPA, 2010). Fecal coliform levels can become elevated near boats during periods of high occupancy and usage (USEPA, 1993). Studies have found that water quality in canals is negatively affected by bacteria suspected to originate from the discharge of sanitary wastes from inhabited moored vessels (IMVs) (BCDNRP, 1994; BCDNRP, 1995).

Wildlife and Sediments

Wildlife and sediments could also contribute to fecal coliform exceedances in each watershed. Wildlife such as iguanas, birds, and raccoons have direct access to the waterbody and can

deposit their feces directly into the water. Wildlife also deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams. Studies have shown that fecal coliform bacteria can survive and reproduce in streambed sediments and can be re-suspended in surface water when conditions are right (Jamieson et al., 2005; Solo-Gabriele et al., 2002).

Current source identification methodologies cannot quantify the exact amount of fecal coliform loading from wildlife and/or sediment sources.

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

Table 4.3. Classification of Land Use Categories for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 in 2004-2005

This is a twelve-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use description, Column 3-12 list the acreage, and percent acreage land use in each WBID.

- = Empty cell/no data

Level 1 Code	Land Use	WBID 3270		WBID 3273		WBID 3274		WBID 3276		WBID 3276A	
		Acreage	% Acreage	Acreage	% Acreage	Acreage	% Acreage	Acreage	% Acreage	Acreage	% Acreage
1000	Urban and built-up	10,998	30.6%	4,173	31.6%	2,726	28.0%	1,647.8	29.3%	1147	25.4%
-	Low-density residential	340	0.9%	47	0.4%	14	0.1%	155.6	2.8%	0	0.0%
-	Medium-density residential	9,198	25.6%	4,089	31.0%	3,423	35.2%	1,820.1	32.4%	2302	50.9%
-	High-density residential	8,847	24.7%	2,983	22.6%	1,541	15.9%	1,317.3	23.4%	658	14.5%
2000	Agriculture	74	0.2%	84	0.6%	0	0.0%	0.0	0.0%	0	0.0%
3000	Rangeland	29	0.1%	24	0.2%	26	0.3%	0.0	0.0%	0	0.0%
4000	Upland forest	374	1.0%	161	1.2%	68	0.7%	23.5	0.4%	16	0.4%
5000	Water	2,746	7.7%	976	7.4%	729	7.5%	229.2	4.1%	87	1.9%
6000	Wetland	850	2.4%	31	0.2%	103	1.1%	35.1	0.6%	0	0.0%
7000	Barren land	40	0.1%	34	0.3%	11	0.1%	3.9	0.1%	0	0.0%
8000	Transportation, communication, and utilities	2,390	6.7%	586	4.4%	1,084	11.1%	388.8	6.9%	313	6.9%
-	TOTAL	35,884	100.0%	13,188	100.0%	9,723	100.0%	5,621	100.0%	4,523	100.0%

Level 1 Code	Land Use	WBID 3277A		WBID 3277C		WBID 3277E		WBID 3279		WBID 3281	
		Acreage	% Acreage	Acreage	% Acreage	Acreage	% Acreage	Acreage	% Acreage	Acreage	% Acreage
1000	Urban and built-up	2,721	26.5%	1,566	28.2%	1126	23.9%	4641	10.2%	4332	29.6%
-	Low-density residential	76	0.7%	1,463	26.3%	0	0.0%	11010	24.3%	1276	8.7%
-	Medium-density residential	3,153	30.7%	897	16.1%	910	19.3%	7344	16.2%	3338	22.8%
-	High-density residential	1,209	11.8%	486	8.7%	688	14.6%	3542	7.8%	2276	15.6%
2000	Agriculture	15	0.2%	3	0.1%	110	2.3%	2772	6.1%	1086	7.4%
3000	Rangeland	32	0.3%	0	0.0%	9	0.2%	1110	2.4%	21	0.1%
4000	Upland forest	191	1.9%	76	1.4%	136	2.9%	978	2.2%	529	3.6%
5000	Water	792	7.7%	532	9.6%	459	9.7%	4897	10.8%	987	6.7%
6000	Wetland	384	3.7%	4	0.1%	324	6.9%	5411	11.9%	28	0.2%
7000	Barren land	7	0.1%	0	0.0%	6	0.1%	130	0.3%	0	0.0%
8000	Transportation, communication, and utilities	1,702	16.5%	527	9.5%	951	20.2%	3533	7.8%	749	5.1%
-	TOTAL	10,281	100.0%	5,555	100.0%	4,719	100.00%	45,367	100.00%	14,623	100.0%

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal/Pompano Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

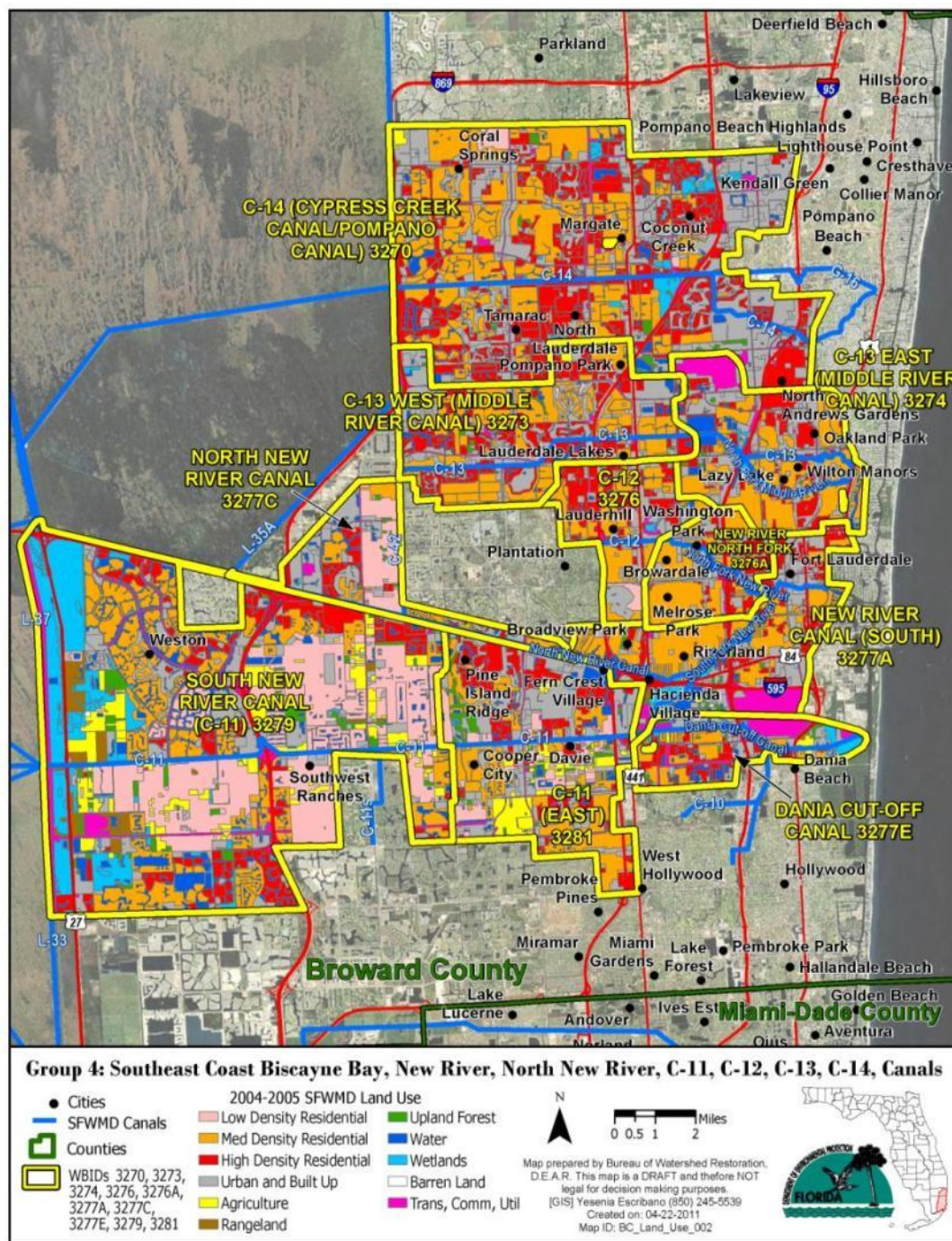


Figure 4.1. Principal Land Uses within Boundaries of WBID 3270, WBID 3273, WBID 3274, WBID 3276, WBID 3276A, WBID 3277A, WBID 3277C, WBID 3277E, WBID 3279 and WBID 3281 in 2004-2005

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

When continuous flow measurements in a watershed are available, a bacteria TMDL can be developed using the load duration curve method. Developed by the Kansas Department of Health and Environment, this method provides the allowable daily bacteria load. Flow data are available for the freshwater WBIDs (3270, 3273, 3276, 3277C, 3279 and 3281) addressed in this report. However, these systems are highly manipulated and regulated by water control structures; as a result, the flow measurements do not necessarily represent the hydrological condition of the waterbody, which is what drives the transport of fecal coliform to the receiving waters. Therefore, fecal coliform TMDLs for these WBIDs were developed using the “percent reduction” approach. Given that WBIDs 3274, 3276A, 3277A and 3277E are marine waterbodies and tidally influenced, the fecal coliform TMDLs for these WBIDs were also developed using the “percent reduction” approach.

Using this method, the percent reduction needed to meet the applicable criterion is calculated based on the 90th percentile of all measured concentrations collected during the Cycle 2 verified period (January 1, 2003, through June 30, 2010). Because bacteriological counts in water are not normally distributed, a nonparametric method is more appropriate for the analysis of fecal coliform data (Hunter, 2002). The Hazen method, which uses a nonparametric formula, was used to determine the 90th percentile value. The percent reduction of fecal coliform needed to meet the applicable criterion was calculated as described in **Section 5.1.2**.

5.1.1 Data Used in the Determination of the TMDL

Data used to develop these TMDLs were collected by the Broward County Department of Planning and Environmental Protection, the Florida Department of Environmental Protection (Tallahassee and Southeast Districts), the South Florida Water Management District, and the Florida Department of Health. The Cycle 2 verified period includes data collected from January 1, 2003 through June, 30, 2010. **Table 5.1** lists the stations where fecal coliform data were collected for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281. **Figure 5.1** shows the locations of these water quality stations.

Table 5.1. Stations where Water Quality Samples Were Collected for Fecal Coliform Data during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the station ID and Column 3 lists the agency.

WBID	Station ID	Agency
3270	21FLBROW109	Broward County Department of Planning and Environmental Protection
	21FLBROW6	Broward County Department of Planning and Environmental Protection
	21FLBROW7	Broward County Department of Planning and Environmental Protection
	21FLBROW8	Broward County Department of Planning and Environmental Protection
	21FLBROW89	Broward County Department of Planning and Environmental Protection
	21FLGW 20029	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34111	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34124	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34125	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34128	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34138	Florida Department of Environmental Protection (Tallahassee)
	21FLWBPB 28030504	Florida Department of Environmental Protection (Southeast District)
	21FLWBPB 28030507	Florida Department of Environmental Protection (Southeast District)
	21FLWBPB 28030508	Florida Department of Environmental Protection (Southeast District)
	21FLWBPB 28030509	Florida Department of Environmental Protection (Southeast District)
	21FLWBPB 28030593	Florida Department of Environmental Protection (Southeast District)
3273	21FLBROW12	Broward County Department of Planning and Environmental Protection
	21FLBROW13	Broward County Department of Planning and Environmental Protection
	21FLBROW14	Broward County Department of Planning and Environmental Protection
	21FLGW 34121	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34136	Florida Department of Environmental Protection (Tallahassee)
3274	21FLBROW10	Broward County Department of Planning and Environmental Protection
	21FLBROW11	Broward County Department of Planning and Environmental Protection
	21FLBROW111	Broward County Department of Planning and Environmental Protection
	21FLBROW112	Broward County Department of Planning and Environmental Protection
	21FLDOH BROWARD31	Florida Department of Health
3276A	21FLGW 33083	Florida Department of Environmental Protection (Tallahassee)
	21FLBROW16	Broward County Department of Planning and Environmental Protection
	21FLBROW64	Broward County Department of Planning and Environmental Protection
3276	21FLBROW17	Broward County Department of Planning and Environmental Protection
	21FLBROW18	Broward County Department of Planning and Environmental Protection
	21FLGW 20027	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 32985	Florida Department of Environmental Protection (Tallahassee)
	21FLWBPB 28030526	Florida Department of Environmental Protection (Southeast District)
	21FLWBPB 42009011	Florida Department of Environmental Protection (Southeast District)
	21FLWBPB 42009012	Florida Department of Environmental Protection (Southeast District)
3277A	21FLBROW15	Broward County Department of Planning and Environmental Protection
	21FLBROW19	Broward County Department of Planning and Environmental Protection
	21FLBROW20	Broward County Department of Planning and Environmental Protection
	21FLBROW90	Broward County Department of Planning and Environmental Protection
	21FLGW 34132	Florida Department of Environmental Protection (Tallahassee)
3277C	21FLBROW21	Broward County Department of Planning and Environmental Protection
	21FLBROW22	Broward County Department of Planning and Environmental Protection
	21FLBROW23	Broward County Department of Planning and Environmental Protection
	21FLGW 32963	Florida Department of Environmental Protection (Tallahassee)
3277E	21FLBROW24	Broward County Department of Planning and Environmental Protection
	21FLBROW26	Broward County Department of Planning and Environmental Protection

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

3279	21FLBROW47	Broward County Department of Planning and Environmental Protection
	21FLBROW28	Broward County Department of Planning and Environmental Protection
	21FLBROW29	Broward County Department of Planning and Environmental Protection
	21FLGW 17405	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 17413	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 20031	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 32965	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34116	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34123	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34129	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34135	Florida Department of Environmental Protection (Tallahassee)
	21FLSFWMC1102.0TS	South Florida Water Management District
	21FLSFWMC1102.1TS	South Florida Water Management District
	21FLSFWMC1102.8TS	South Florida Water Management District
	21FLSFWMC1103.3TS	South Florida Water Management District
	21FLSFWMC1104.3TS	South Florida Water Management District
	21FLSFWMC1104.6TS	South Florida Water Management District
3281	21FLBROW27	Broward County Department of Planning and Environmental Protection
	21FLGW 32982	Florida Department of Environmental Protection (Tallahassee)
	21FLGW 34119	Florida Department of Environmental Protection (Tallahassee)

Table 5.2 summarizes the descriptive statistics for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 for the Cycle 2 verified period fecal coliform results based on IWR Run 41x.

Table 5.2. Descriptive Statistics of Fecal Coliform Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 for the Cycle 2 Verified Period (January 1, 2003 - June 30, 2010)

This is a nine-column table. Column 1 lists the WBID number, and Columns 2-9 list the descriptive statistic and corresponding result.

¹ Coliform counts are #/100mL.

WBID	Mean observation ¹	Standard deviation	Median observation ¹	Highest observation ¹	Lowest observation ¹	25% quartile ¹	75% quartile ¹	# of samples
3270	282	627	110	5,200	1.8	44	230	144
3273	226	424	69	2,600	1.8	30	233	70
3274	570	1,297	244	9,600	1	74	530	153
3276	570	1,484	94	7,400	6	32	385	57
3276A	1,734	2,509	630	10,000	150	400	1,600	53
3277A	675	1,342	220	6,400	7	95	480	111
3277C	288	690	98	5,800	1.8	39	288	84
3277E	823	1,752	250	9,400	1.8	5	410	67
3279	510	1,480	205	9,800	1.8	57	443	74
3281	1,415	2,383	400	9,100	44	140	1,500	30

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

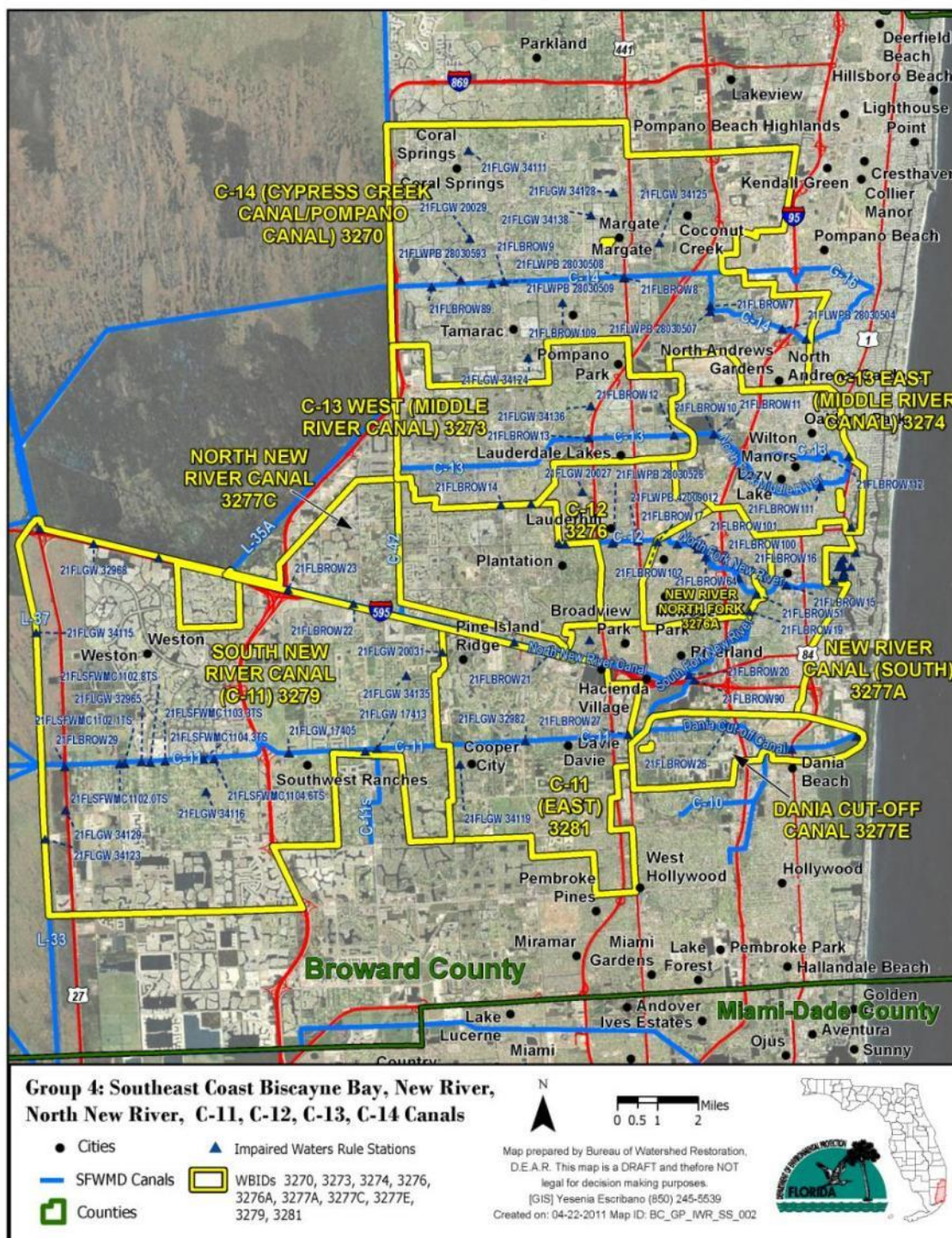


Figure 5.1. Location of Water Quality Stations with Fecal Coliform Data in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281

Plots of fecal coliform data by time determined whether there was a significant increasing or decreasing trend during the period of observation (January 1, 2003 – June 30, 2010) for each WBID. No significant increasing or decreasing trends were observed in WBIDs 3270 (Prob > F= 0.5911), 3273 (Prob > F= 0.8652), 3274 (Prob > F=0.5106), 3276 (Prob > F=0.2117), 3276A (Prob > F=0.6629), 3277A (Prob > F=0.6914), 3277C (Prob > F=0.3034), 3277E (Prob > F=0.2866) and 3281 (Prob > F=0.1078).

Although a significant increasing trend was observed in WBID 3279 (Prob < 0.05) during the Cycle 2 verified period, this statistical significance is being driven by three high values and, therefore, does not accurately represent a specific long term trend, but rather a trend driven by occasional events. If these three data points are removed from the analysis a significant increasing trend is no longer observed.

Figures 5.2a – 5.2j show the fecal coliform concentration values over time during the Cycle 2 verified period (January 1, 2003 through June, 30, 2010) observed in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281.

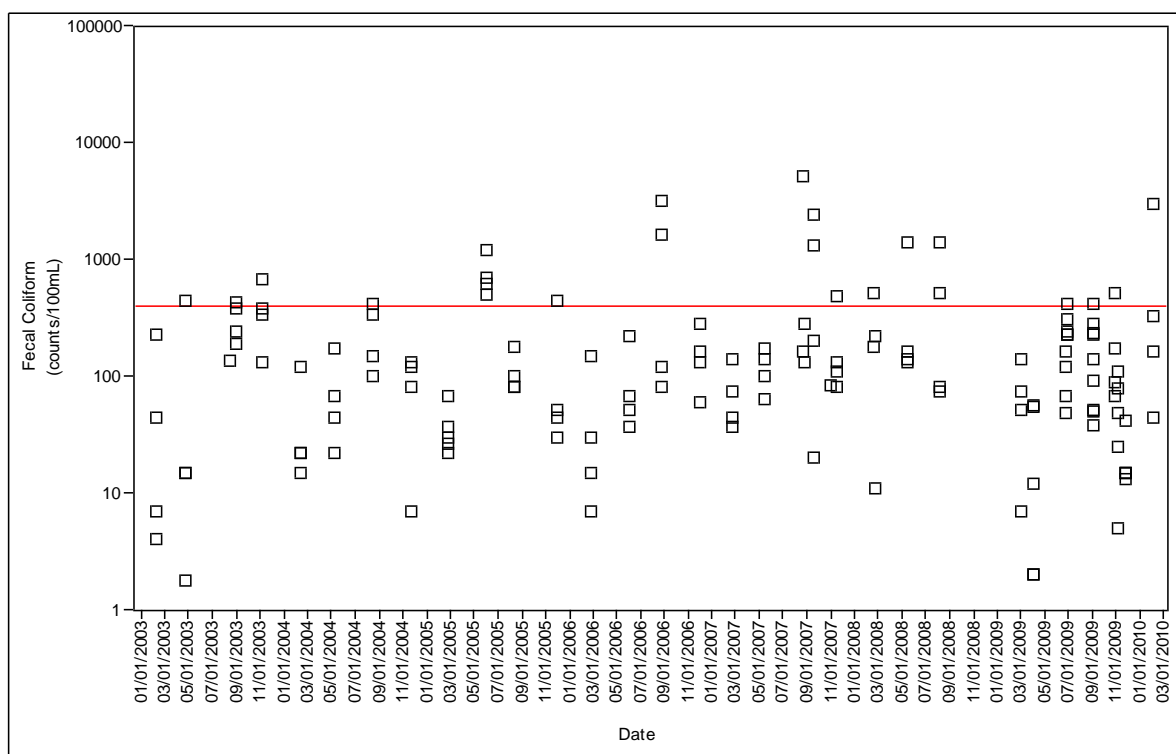


Figure 5.2a. Fecal Coliform Concentrations over Time in the C-14 (Cypress Creek) Canal (WBID 3270) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

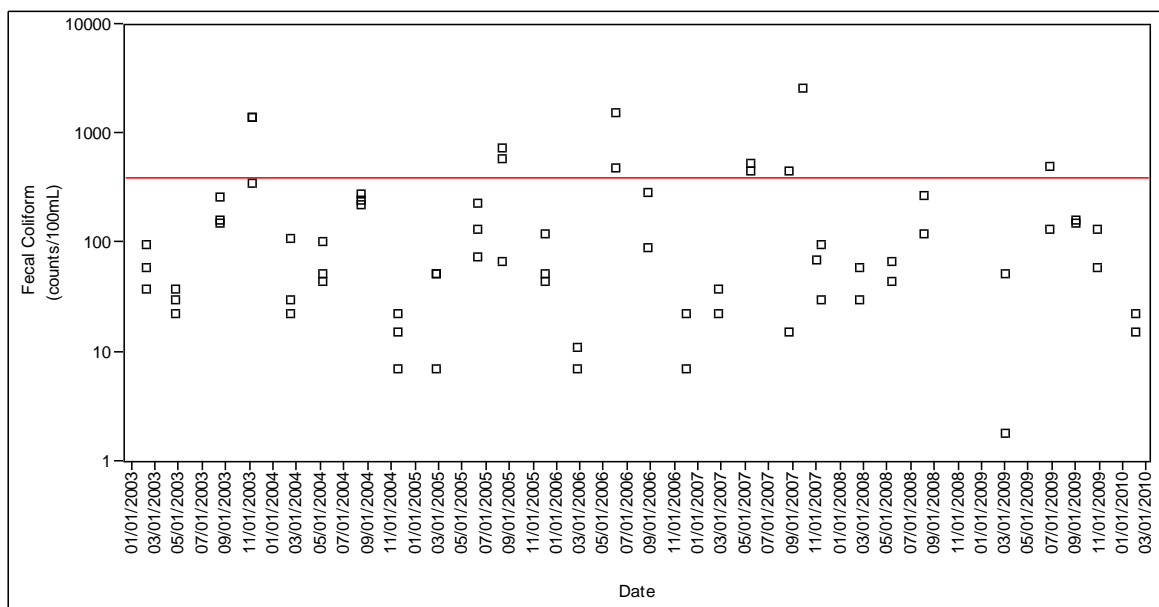


Figure 5.2b. Fecal Coliform Concentrations over Time in the C-13 West (Middle River) Canal (WBID 3273) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

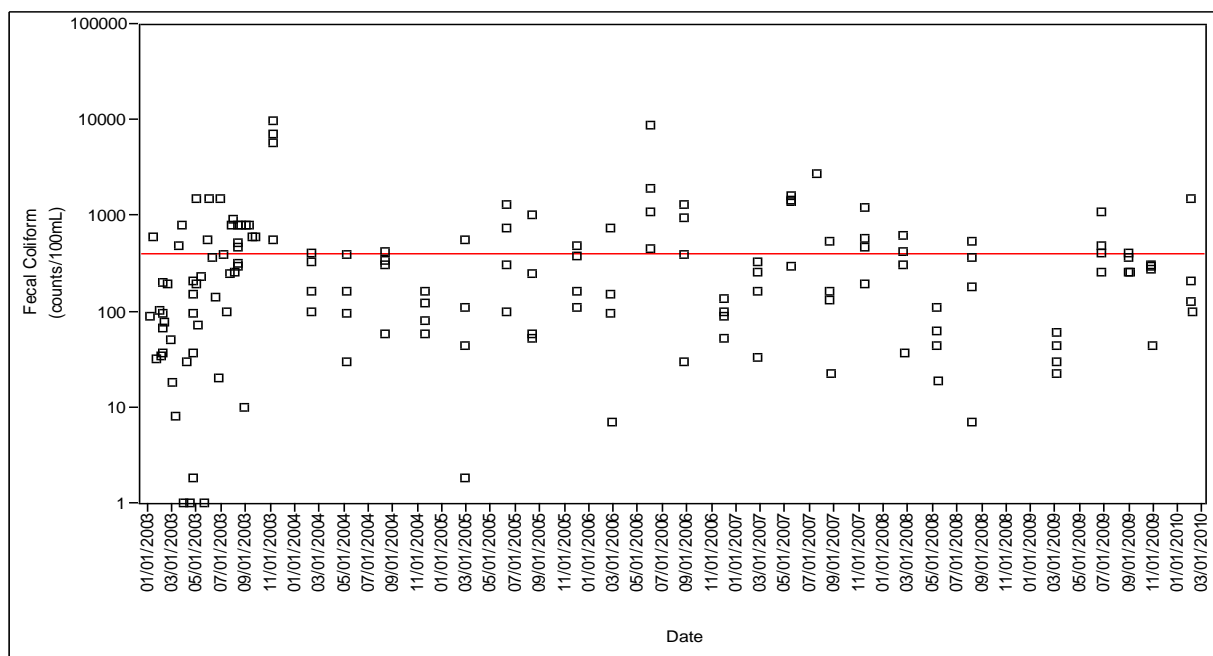


Figure 5.2c. Fecal Coliform Concentrations over Time in the C-13 East (Middle River) Canal (WBID 3274) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

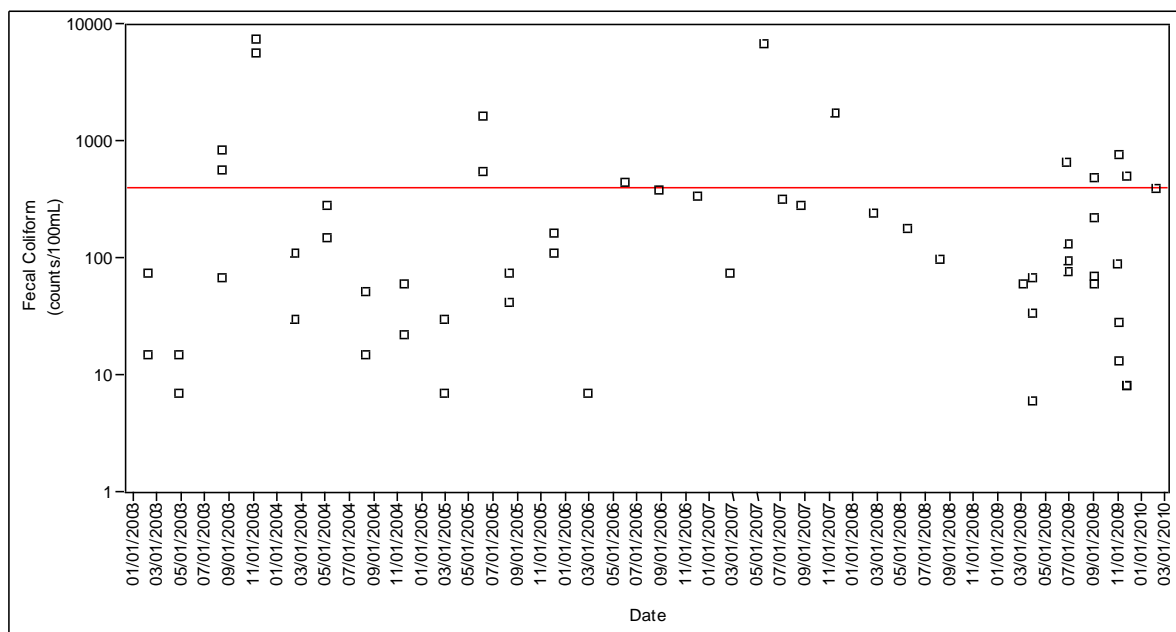


Figure 5.2d. Fecal Coliform Concentrations over Time in the C-12 Canal (WBID 3276) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

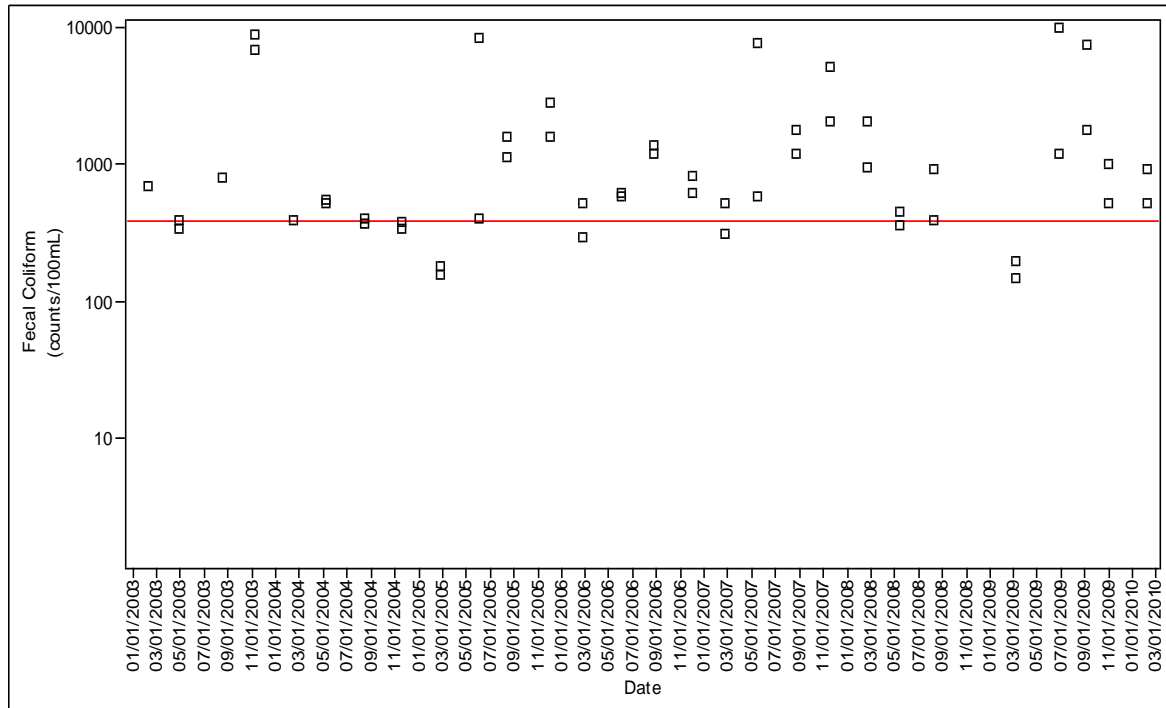


Figure 5.2e. Fecal Coliform Concentrations over Time in the New River (North Fork) (WBID 3276A) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

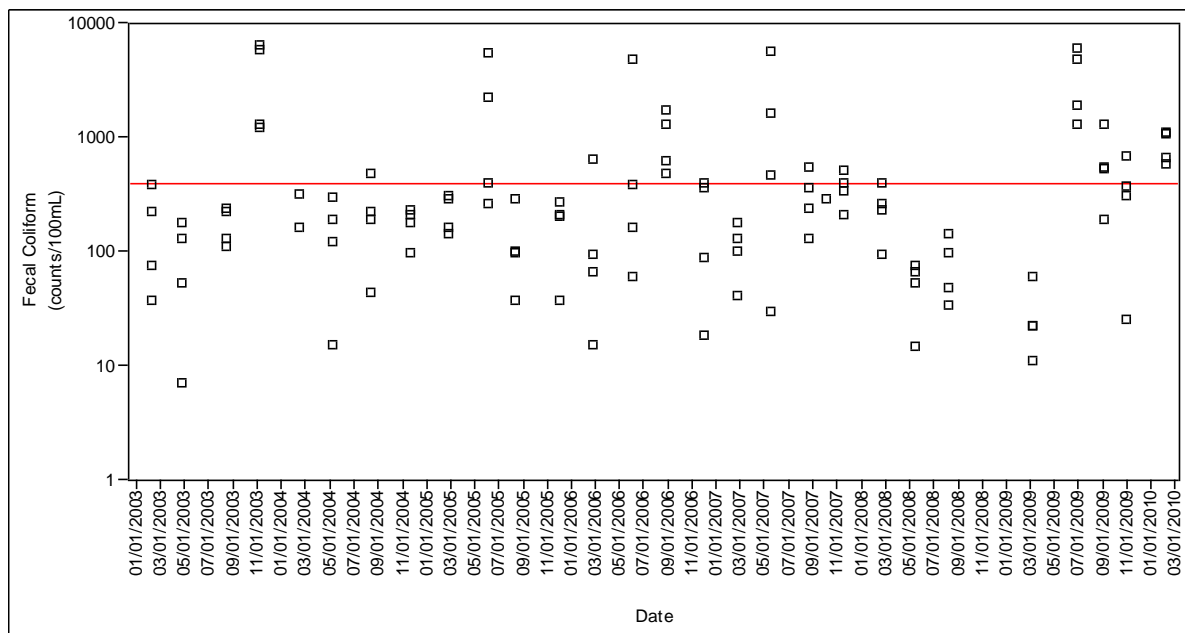


Figure 5.2f. Fecal Coliform Concentrations over Time in the New River Canal (South) (WBID 3277A) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

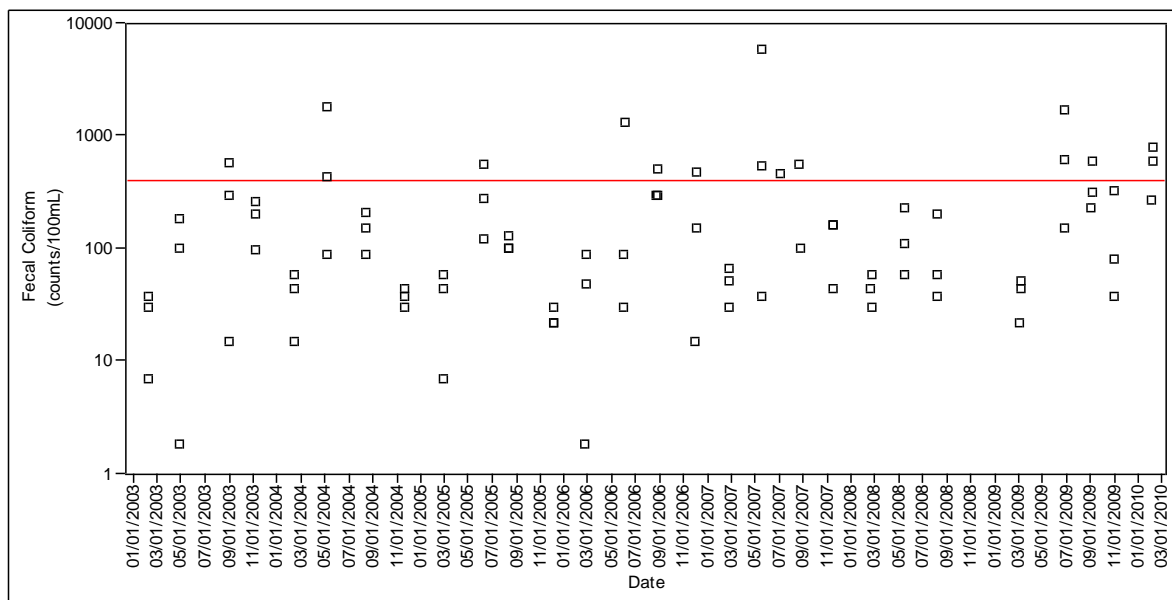


Figure 5.2g. Fecal Coliform Concentrations over Time in the North New River Canal (WBID 3277C) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

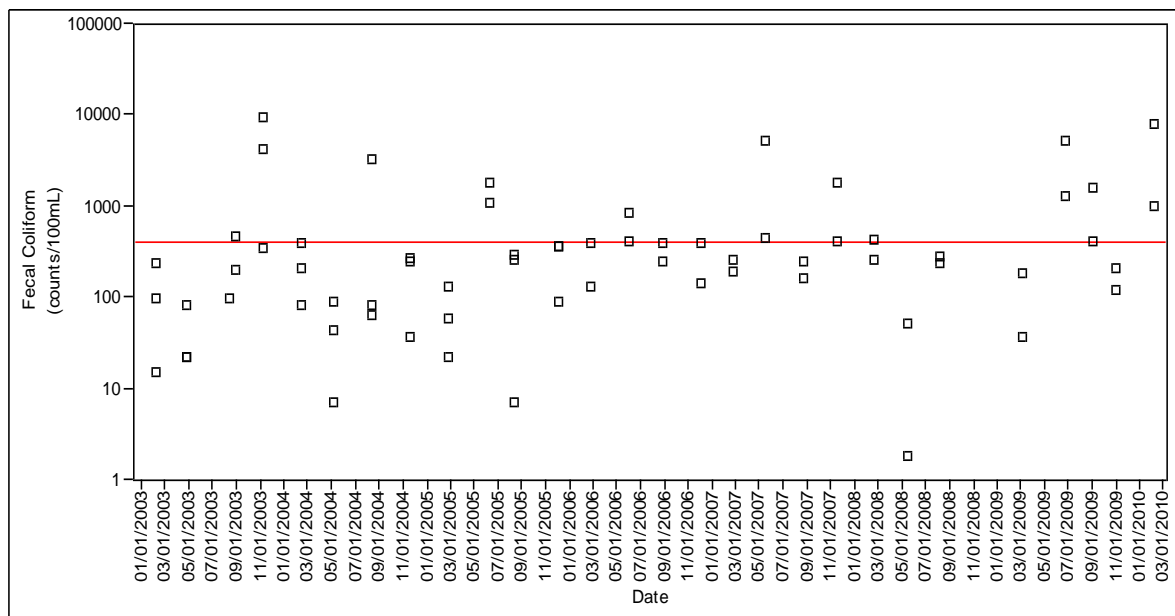


Figure 5.2h. Fecal Coliform Concentrations over Time in the Dania Cut-off Canal (WBID 3277E) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

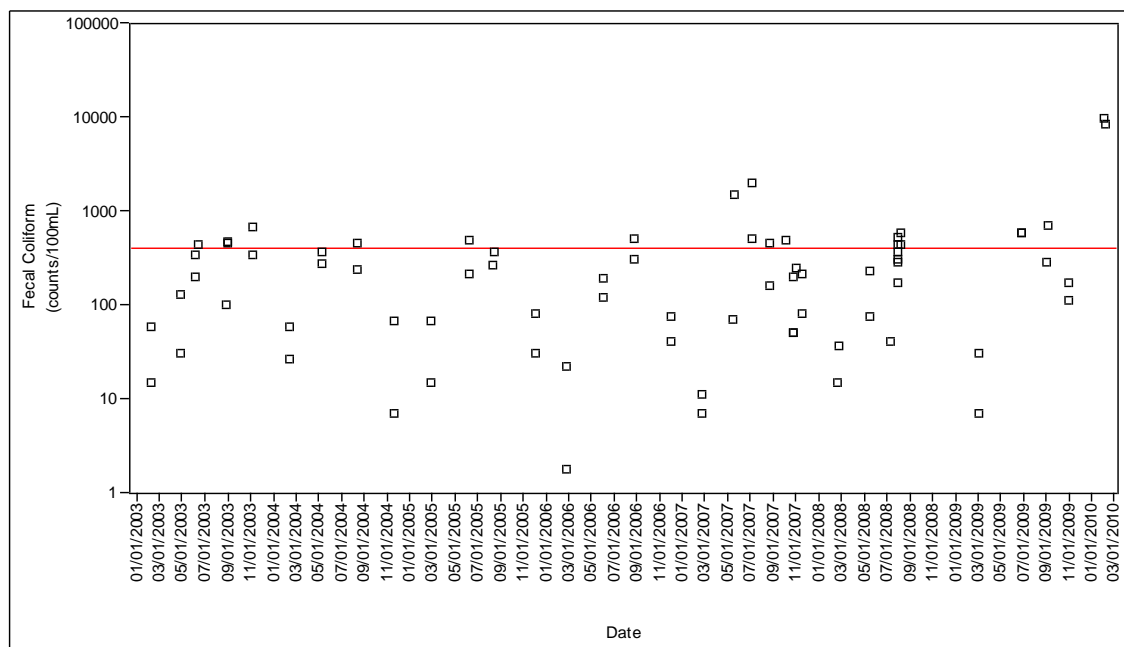


Figure 5.2i. Fecal Coliform Concentrations over Time in the South New River Canal (C-11) (WBID 3279) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

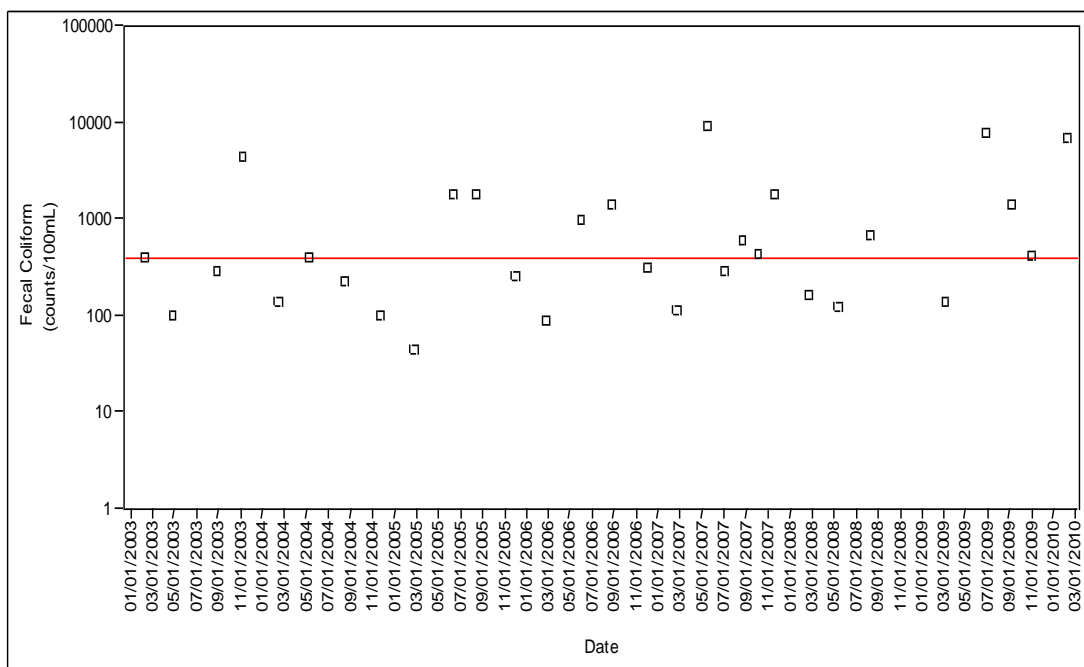


Figure 5.2j. Fecal Coliform Concentrations over Time in the C-11 (East) (WBID 3281) for the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

Temporal Patterns

MONTHLY AND SEASONAL TRENDS

Seasonally, in an impaired water influenced mainly by nonpoint sources, a peak in fecal coliform concentrations and exceedance rates is commonly observed during the third quarter (summer, July–September), when conditions are rainy and warm, and lower concentrations and exceedance rates in the first and fourth quarters (winter, January–March; and fall, October–December), when conditions are drier and colder (**Tables 5.3a – 5.3t**).

The WBIDs addressed in this report are located in an environment of extremes, dry in winter and wet in summer, with rainfall not distributed evenly either temporally or spatially (BCNRPMD, 2009). In addition, rainfall variability from year to year is high, resulting in periodic droughts and floods (BCNRPMD, 2009). This area is characterized by a subtropical climate where the annual average rainfall is between 45 and 60 inches of rain, with three-fourths of rainfall occurring between May and November (BCNRPMD, 2009), and an average annual temperature in Broward County of 74.4°F, with a mean winter temperature of 66.5°F and a mean summer temperature of 84.2°F (BCPRD, 2003). Rainy and warm conditions occur throughout most of the year.

C-14 (Cypress Creek) Canal (WBID 3270)

The highest quarterly exceedance rate and highest quarterly average fecal coliform concentration were observed during the rainy and warmer season (26.3% and 555.8 counts/100mL, respectively). The lowest exceedance rate was observed during the first quarter, the cooler and drier season (5.3%). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010). With the exception of March, fecal coliform exceedances were observed in the C-14 canal in all the other months in which measured fecal coliform concentrations were available. The highest monthly average fecal coliform concentration was observed in September (980 counts/100mL). **Tables 5.3a and 5.3b** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3a. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3270 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	29	4	3,000	44	193	2	6.9
March	9	2	140	52	44	0	0
April	4	1.8	440	15	118	1	25
May	14	22	1,400	115	193	1	7.1
June	15	48	1,200	230	342	5	33.3
July	0	-	-	-	-	-	-
August	34	38	5,200	170	506	8	23.5
September	4	20	2,400	750	980	2	50
October	5	67	520	89	186	1	20
November	30	5	670	81	141	3	10
December	0	-	-	-	-	-	-

Table 5.3b. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3270 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	38	2	3,000	44	158	2	5.3
Quarter 2	33	1.8	1400	140	251	7	21.2
Quarter 3	38	20	5,200	185	556	10	26.3
Quarter 4	35	5	670	84	147	4	11.4

C-13 West (Middle River) Canal (WBID 3273)

The highest quarterly exceedance rate was observed in the second quarter (29.4%) and the highest quarterly average fecal coliform concentration was observed during the third quarter (380.1 counts/100mL). No exceedances were observed during the cooler and drier months. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010); with the highest concentration observed in September (2,600 counts/100mL). **Tables 5.3c** and **5.3d** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3c. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3273 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	17	7	110	30	39	0	0.0
March	2	1.8	52	26.9	27	0	0.0
April	3	22	37	30	30	0	0.0
May	7	44	530	67	184	2	28.6
June	7	74	1550	230	441	3	42.9
July	0	-	-	-	-	-	-
August	17	15	730	220	250	3	17.6
September	1	2600	2600	2,600	2,600	1	100
October	3	59	130	70	86	0	0
November	10	7	1,400	26	335	2	20.0
December	3	44	120	52	72	0	0

Table 5.3d. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3273 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	19	1.8	110	30	38	0	0.0
Quarter 2	17	22	1550	100	262	5	29.4
Quarter 3	18	15	2,600	230	380	4	22.2
Quarter 4	16	7	1,400	55.5	239	2	12.5

C-13 East (Middle River) Canal (WBID 3274)

Quarterly exceedance rates were observed in all four quarters, with the highest quarterly exceedance rate observed in the rainy, warmer season (42.9%) and the highest quarterly average fecal coliform concentration observed in the fourth quarter (1,184.4 counts/100mL). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010). With the exception of October, exceedances were observed year-round, with the greatest exceedance rates observed in September (80%). The highest monthly average fecal coliform concentration was observed in November (1,648.8 counts/100mL). **Tables 5.3e** and **5.3f** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3e. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3274 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	4	32	600	95	206	1	25
February	32	1.8	1,500	137.5	236	6	18.8
March	9	1	800	30	163	2	22.2
April	9	1	1500	96	246	1	11.1
May	16	1	1,600	135	407	4	25.0
June	17	20	8,800	490	1,204	10	58.8
July	6	98	2,700	598	856	3	50
August	31	7	1,300	320	373	11	35.5
September	5	260	800	600	612	4	80
October	4	44	310	280	229	0	0
November	16	52	9,600	177.5	1,649	7	43.8
December	4	110	480	270	283	1	25

Table 5.3f. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3274 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	45	1	1,500	100	219	9	20.0
Quarter 2	42	1	8800	247	695	15	35.7
Quarter 3	42	7	2,700	367.5	471	18	42.9
Quarter 4	24	44	9,600	232.5	1,184	8	33.3

C-12 (WBID 3276)

Elevated quarterly average fecal coliform concentrations and high exceedance rates were observed during the second (38.5% and 843.3 counts/100mL, respectively) and fourth quarters (33.3% and 1,120.1 counts/100mL, respectively). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010), with the highest monthly average fecal coliform concentration observed in May (1,570 counts/100mL). **Tables 5.3g** and **5.3h** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3g. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	10	7	390	52	98	0	0.0
March	4	6	68	46.5	42	0	0.0
April	2	7	15	11	11	0	0.0
May	5	150	6800	280	1,570	2	40.0
June	6	76	1600	335.5	515	3	50.0
July	1	320	320	320	320	0	0.0
August	13	15	830	74	212	2	15.4
September	1	490	490	490	490	1	100.0
October	1	89	89	89	89	0	0.0
November	14	8	7,400	135	1,194	5	35.7
December	0	-	-	-	-	-	-

Table 5.3h. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	14	6	390	46.5	82	0	0.0
Quarter 2	13	7	6800	180	843	5	38.5
Quarter 3	15	15	830	96	238	3	20.0
Quarter 4	15	8	7,400	110	1,120	5	33.3

New River (North Fork) (WBID 3276A)

Elevated fecal coliform concentrations and high exceedance rates were observed during every quarter (50% and greater). The highest quarterly average fecal coliform concentration (2,587.5 counts/100mL) was recorded during the fourth quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010). Excluding March and April, high exceedance rates and fecal coliform concentrations were observed during every month (no samples were collected in January, July or December); with all monthly exceedance rates observed being greater than 50%. The highest monthly average fecal coliform concentration was observed in June (5,002.5 counts/100mL). **Tables 5.3i** and **5.3j** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3i. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	12	160	2,100	520	634	7	58.3
March	2	150	200	175	175	0	0
April	2	340	390	365	365	0	0
May	8	360	7800	570	1,439	7	87.5
June	4	410	10000	4,800	5,003	4	100.0
July	0	-	-	-	-	-	-
August	11	370	1,800	1,150	1024	9	81.8
September	2	1800	7600	4,700	4,700	2	100
October	2	530	1000	765	765	2	100
November	10	340	8,800	1,850	2,952	8	80
December	0	-	-	-	-	-	-

Table 5.3j. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276A by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	14	150	2,100	460	569	7	50.0
Quarter 2	14	340	10000	570	2,304	11	78.6
Quarter 3	13	370	7,600	1,200	1,589	11	84.6
Quarter 4	12	340	8,800	1,300	2,588	10	83.3

New River Canal (South) (WBID 3277A)

The highest quarterly average fecal coliform concentration and the highest exceedance rate were observed during the second quarter (1,305 counts/100mL and 35.7%, respectively). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010), with the highest monthly average fecal coliform concentration in the WBID observed in June (2,781.3 counts/100mL). **Tables 5.3k** and **5.3l** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3k. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	26	15	1,100	200	298	5	19.2
March	4	11	59	22	29	0	0
April	4	7	180	91	92	0	0
May	16	14.5	5600	140	870	4	25.0
June	8	260	6000	2,050	2,781	6	75.0
July	0	-	-	-	-	-	-
August	24	33.5	1,700	205	326	6	25.0
September	4	190	1300	540	643	3	75
October	5	25.5	680	310	335	1	20
November	20	18.5	6,400	250	922	5	25
December	0	-	-	-	-	-	-

Table 5.3l. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277A by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	30	11	1,100	160	262	5	16.7
Quarter 2	28	7	6000	225	1,305	10	35.7
Quarter 3	28	33.5	1,700	205	326	6	25.0
Quarter 4	25	18.5	6,400	310	782	9	31.0

North New River Canal (WBID 3277C)

Exceedances were observed during every quarter, with the highest quarterly exceedance rate and elevated quarterly average fecal coliform concentration observed during the second quarter (38.1% and 676 counts/100mL, respectively). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010), with elevated fecal coliform concentrations and exceedances observed all months except March, April, October and December (no samples were collected in January). The highest monthly average fecal coliform concentration was observed in May (836.7 counts/100mL). **Tables 5.3m** and **5.3n** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3m. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277C by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	21	1.8	800	44	114	2	9.5
March	3	22	52	44	39	0	0
April	3	1.8	180	100	94	0	0
May	11	30	5800	110	837	4	36.4
June	7	120	1700	550	673	4	57.1
July	1	460	460	460	460	1	100
August	17	15	580	150	217	3	17.6
September	3	230	590	310	377	1	33.3
October	3	37	320	81	146	0	0
November	12	15	470	123	139	1	8.3
December	3	22	30	22	25	0	0

Table 5.3n. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277C by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	24	1.8	800	44	105	2	8.3
Quarter 2	21	1.8	5800	180	676	8	38.1
Quarter 3	21	15	590	210	251	5	23.8
Quarter 4	18	15	470	62.5	121	1	5.6

Dania Cut-off Canal (WBID 3277E)

Elevated fecal coliform concentrations and high exceedance rates were observed during every quarter, with the highest quarterly average fecal coliform concentration observed during the fourth quarter (1,225.7 counts/100mL), and the highest exceedance rate observed during the second quarter (43.8%). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010), with the highest monthly average fecal coliform concentration observed in June (1,771.7 counts/100mL). No samples were collected in January or July. **Tables 5.3o** and **5.3p** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3o. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277E by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	17	15	7,800	210	688	3	17.6
March	2	37	180	108.5	109	0	0
April	3	22	81	22	42	0	0
May	7	1.8	5200	52	835	2	28.6
June	6	400	5200	1200	1,772	5	83.3
July	0	-	-	-	-	-	-
August	15	7	3,200	250	415	2	13.3
September	2	410	1600	1005	1,005	2	100
October	2	120	210	165	165	0	0
November	10	37	9,400	370	1,725	4	40
December	3	89	360	360	270	0	0

Table 5.3p. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277E by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	19	15	7,800	190	627	3	15.8
Quarter 2	16	1.8	5200	244.5	1,037	7	43.8
Quarter 3	17	7	3,200	250	485	4	23.5
Quarter 4	15	37	9,400	350	1,226	4	26.7

South New River Canal (C-11) (WBID 3279)

Elevated fecal coliform concentrations and exceedance rates were observed during every quarter, with the highest quarterly exceedance rate observed during the third quarter (50%), and the highest quarterly average fecal coliform concentration observed during the first quarter (1,160.7 counts/100mL). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010). Excluding March, April and December, exceeding fecal coliform concentrations were observed during every month, with monthly exceedance rates ranging between 12.5 % and 53.8%. The highest monthly average fecal coliform concentration was observed in February (1,323.9 counts/100mL). No samples were collected in January. **Tables 5.3q** and **5.3r** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3q. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3279 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	14	1.8	9,800	24	1,324	2	14.3
March	2	7	30	18.5	19	0	0.0
April	2	30	130	80	80	0	0.0
May	7	70	1500	230	376	1	14.3
June	8	190	590	390	380	4	50.0
July	9	41	2,000	360	514	4	44.4
August	13	100	580	430	369	7	53.8
September	2	280	700	490	490	1	50.0
October	7	50	490	170	189	1	14.3
November	8	7	670	77.5	186	1	12.5
December	2	30	81	55.5	56	0	0.0

Table 5.3r. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3279 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	16	1.8	9,800	24	1,161	2	12.5
Quarter 2	17	30	1500	230	343	5	29.4
Quarter 3	24	41	2,000	400	433	12	50.0
Quarter 4	17	7	670	81	172	2	11.8

C-11 (East) (WBID 3281)

Elevated fecal coliform concentrations and exceedance rates were observed during every quarter, with exceedance rates being greater than 50% during the second, third and fourth quarters (57.1%, 62.5% and 57.1%, respectively). The highest quarterly average fecal coliform concentration was observed during the second quarter (2,867.6 counts/100mL). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003-2010). Excluding March, April, July and December, exceeding fecal coliform concentrations were observed during every month, with all monthly exceedance rates ranging between 14.3% and 100%. The highest monthly average fecal coliform concentration was observed in June (3,450 counts/100mL). No samples were collected in January. **Tables 5.3s** and **5.3t** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3s. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3281 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Month	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
January	0	-	-	-	-	-	-
February	7	44	6,950	140	1,128	1	14.3
March	1	140	140	140	140	0	0
April	1	100	100	100	100	0	0
May	3	123	9100	400	3,208	1	33.3
June	3	950	7600	1,800	3,450	3	100
July	1	280	280	280	280	0	0
August	6	220	1,800	627.5	828	4	66.7
September	1	1400	1400	1,400	1,400	1	100
October	2	420	430	425	425	2	100
November	4	100	4,400	1,052.5	1,651	2	50
December	1	250	250	250	250	0	0

Table 5.3t. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3281 by Season during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Season	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
Quarter 1	8	44	6,950	140	1,004	1	12.5
Quarter 2	7	100	9100	950	2,868	4	57.1
Quarter 3	8	220	1,800	627.5	831	5	62.5
Quarter 4	7	100	4,400	420	1,101	4	57.1

Using rainfall data collected at various South Florida Water Management District (SFWMD) rainfall stations available on the DBHYDRO Database: (http://www.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_menu) (Table 5.4), it was possible to compare monthly rainfall with monthly fecal coliform exceedance rates, as well as average quarterly rainfall with average quarterly fecal coliform exceedance rates at all stations (Figures 5.3a - 5.3t).

Table 5.4. South Florida Water Management District (SFWMD) Rainfall Stations Used to Determine Monthly and Quarterly Rainfall Data for each WBID

This is a two-column table. Column 1 lists the WBID; Column 2 lists SFWMD rainfall stations.

WBID	SFWMD Rainfall Station
3270	S37B_R
3273	S37B_R
3274	S36_R
3276	S125_R
3276A	S33_R
3277A	G54_R
3277C	S125_R
3277E	S13_R
3279	SBDD
3281	FT. LAUD_R

C-14 (Cypress Creek) Canal (WBID 3270)

During the Cycle 2 verified period, monthly exceedances were recorded in WBID 3270 during drier and wetter periods (**Figure 5.3a**); however, quarterly exceedances were recorded only during wetter months. The occurrence of exceedances after periods of rain is an indication that in WBID 3270 high rainfall serves to negatively impact water quality in this basin (**Figure 5.3b**).

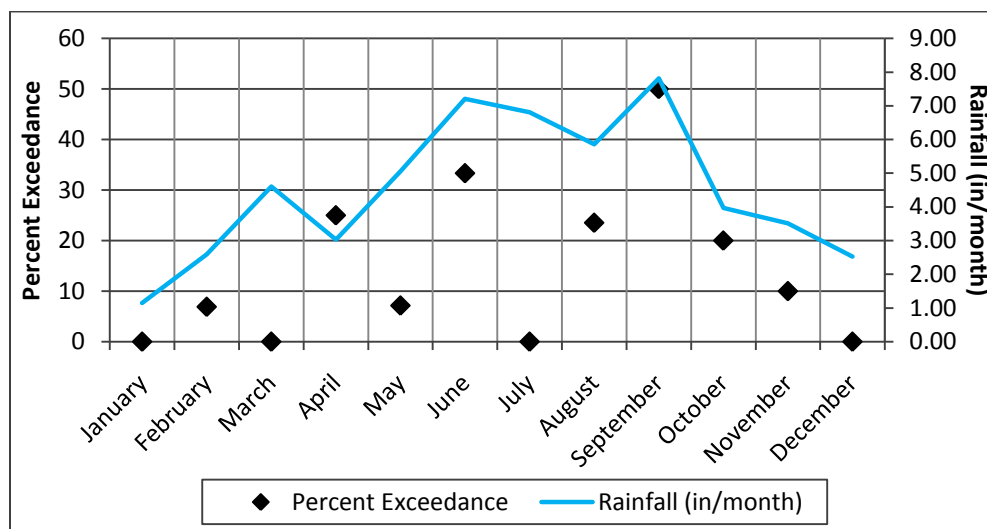


Figure 5.3a. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3270 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

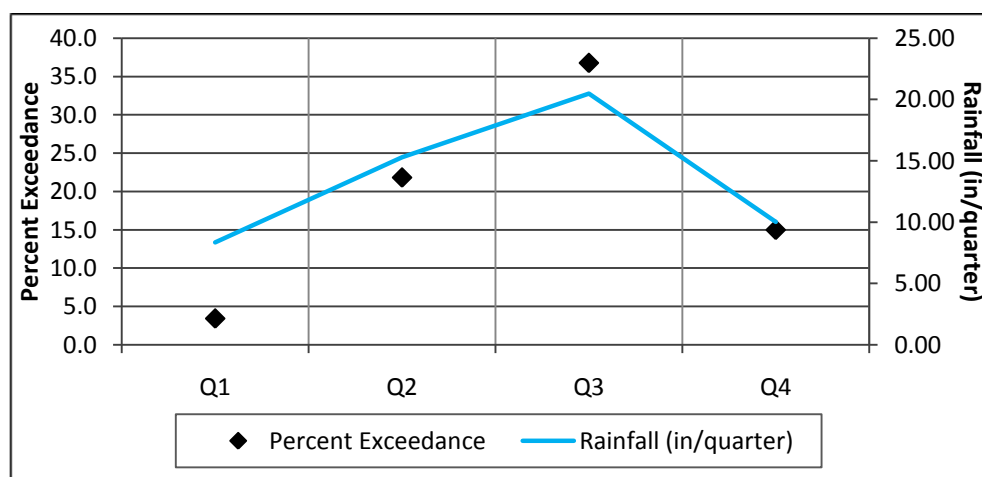


Figure 5.3b. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3270 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

C-13 West (Middle River) Canal (WBID 3273)

The impact of rainfall on monthly and quarterly exceedances in WBID 3273 is inconclusive, as during the Cycle 2 verified period, both monthly exceedance and non-exceedances were recorded during wetter months (**Figures 5.3c**). Quarterly exceedances were recorded only during the last three quarters of the year; all three exceedances coincide with wetter months (**Figure 5.3d**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3273 high rainfall serves to negatively impact water quality in this basin.

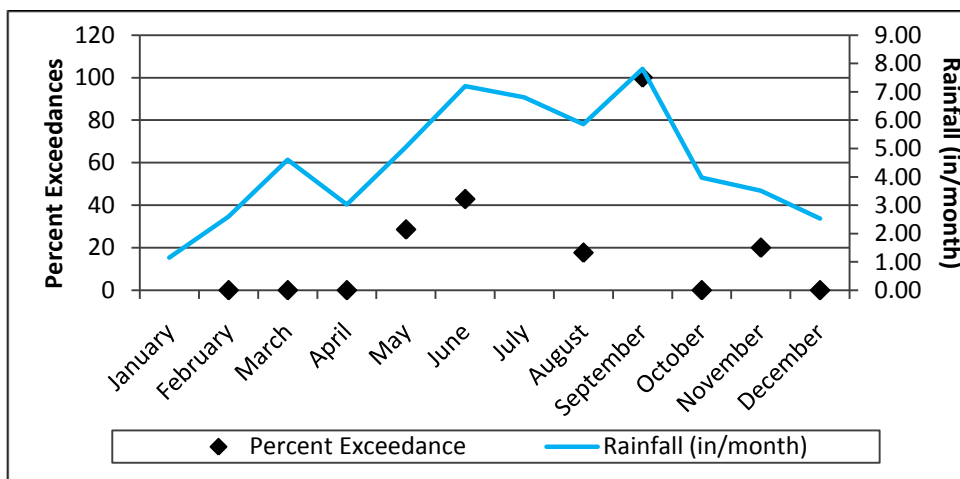
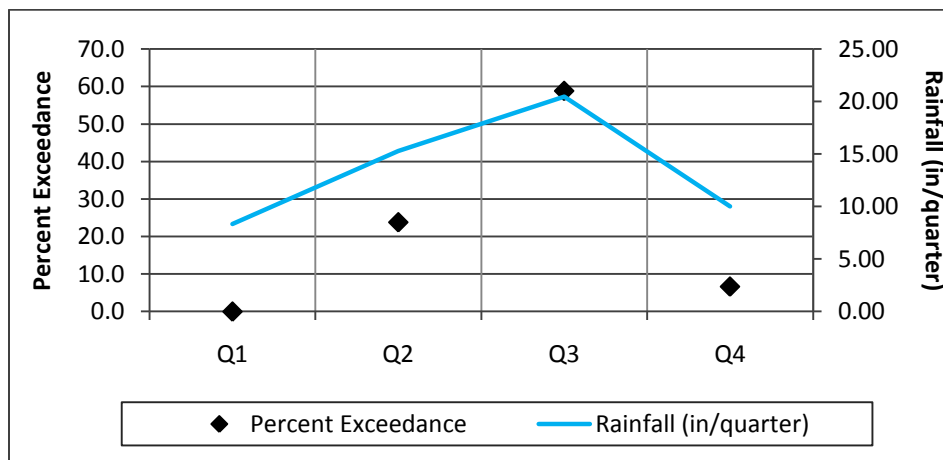


Figure 5.3c. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3273 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)



**Figure 5.3d. Fecal Coliform Exceedances and Rainfall at All Stations in
WBID 3273 by Quarter during the Cycle 2 Verified Period
(January 1, 2003 through June 30, 2010)**

C-13 East (Middle River) Canal (WBID 3274)

The impact of rainfall on monthly and quarterly exceedances in WBID 3274 is more distinct. With the exception of a couple of instances, during the Cycle 2 verified period, higher monthly exceedance rates occurred mostly in wetter months (**Figure 5.3e**). A similar trend was observed with quarterly exceedance rates. Exceedance rates appear to be positively correlated with the quarterly rainfall amount (**Figure 5.3f**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3274 high rainfall serves to negatively impact water quality in this basin.

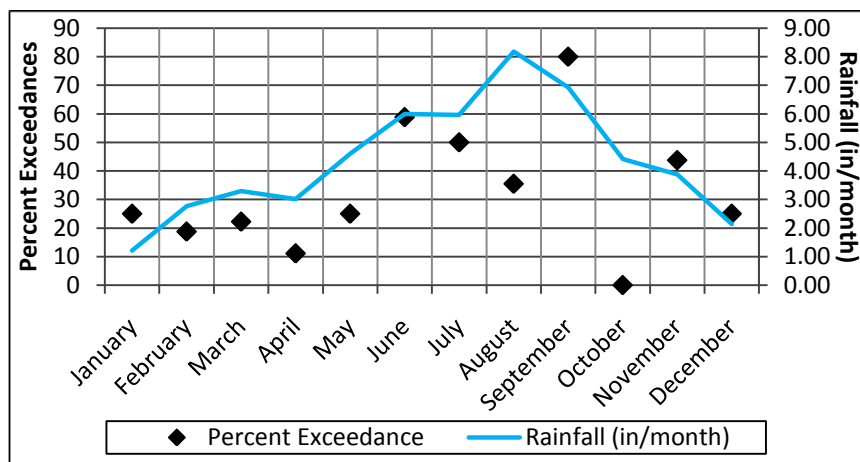


Figure 5.3e. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3274 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

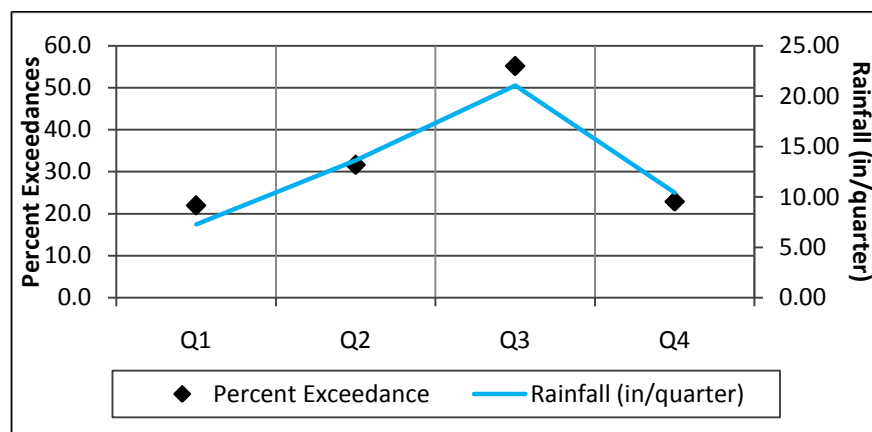


Figure 5.3f. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3274 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

C-12 (WBID 3276)

The impact of rainfall on monthly and quarterly exceedances in WBID 3276 is inconclusive, as during the Cycle 2 verified period, monthly exceedance rates do not appear to be correlated with monthly rainfall (**Figures 5.3g**). However, higher exceedance rates were mostly observed during the wetter months. Quarterly exceedance rates were higher during the last three quarters, which are wetter quarters of the year (**Figure 5.3h**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3276 high rainfall serves to negatively impact water quality in this basin.

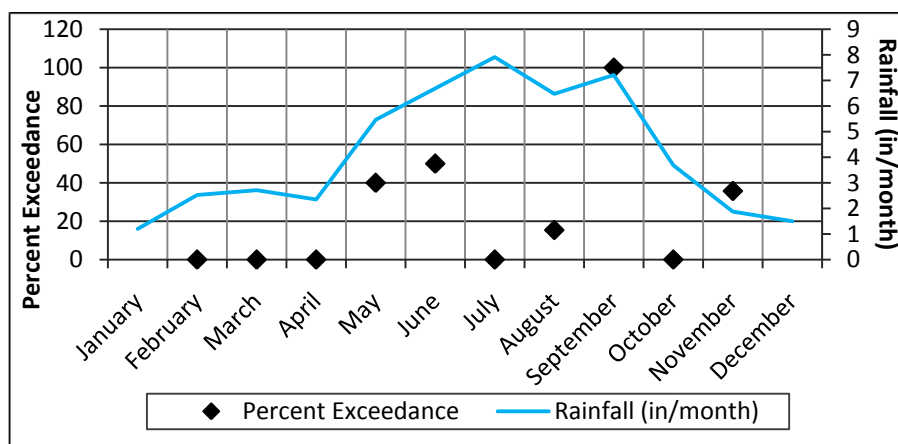


Figure 5.3g. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

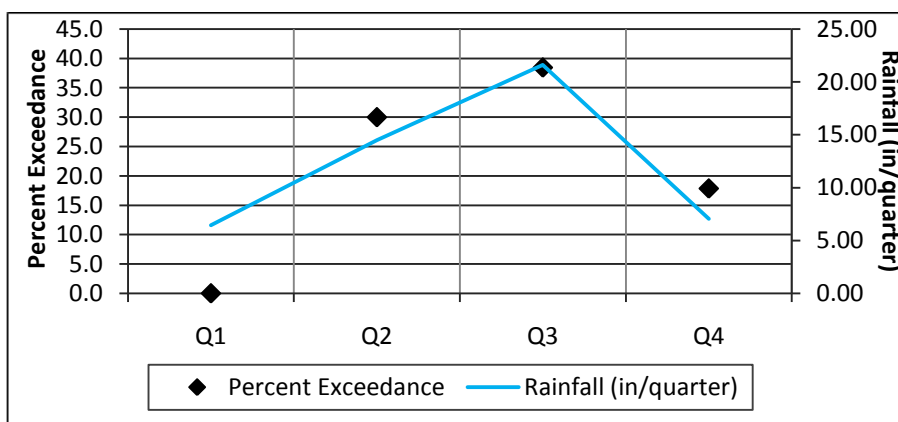


Figure 5.3h. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

New River (North Fork) (WBID 3276A)

With the exception of March and April, exceedances were observed in all the other months during which fecal samples were collected. In general, during the Cycle 2 verified period, higher monthly exceedance rates occurred during wetter months (**Figure 5.3i**). Quarterly exceedance rates also generally correlated with the quarterly rainfall (**Figure 5.3j**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3276A high rainfall serves to negatively impact water quality in this basin.

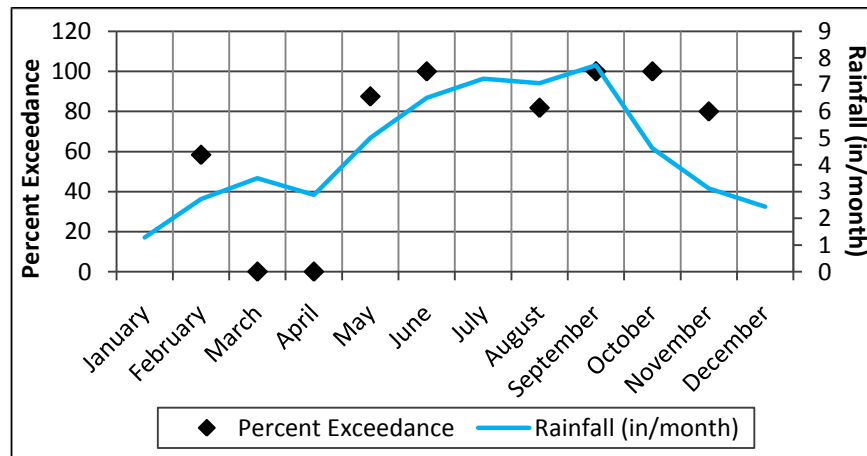


Figure 5.3j. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

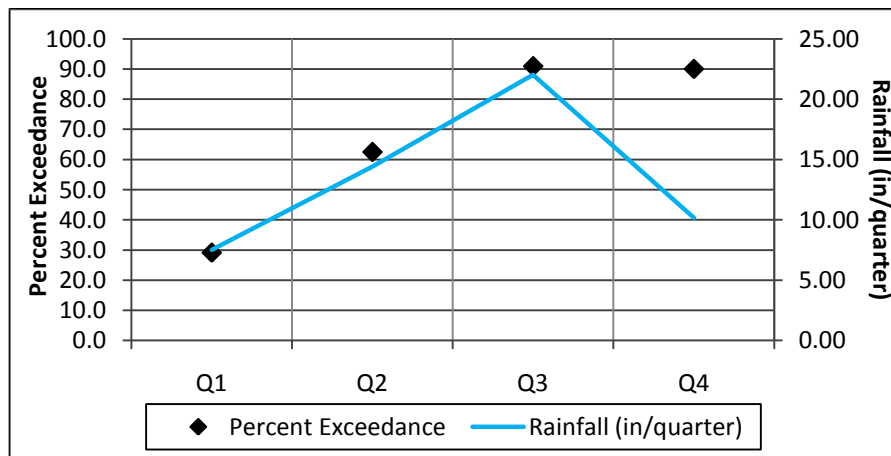


Figure 5.3j. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276A by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

New River Canal (South) (WBID 3277A)

Although there is no strong correlation between monthly exceedance rate and monthly total rainfall, high exceedance rates (above 70%) were indeed observed during the wettest months (**Figure 5.3k**). In WBID 3277A, quarterly exceedance rates generally follow the trend of rainfall except for the third quarter when the quarterly exceedance rate dropped during the wettest quarter (**Figure 5.3l**). It should be noted that the third quarter exceedance rate was calculated based on one sample collected in August, which may not represent the average condition of the whole quarter. The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3277A high rainfall serves to negatively impact water quality in this basin.

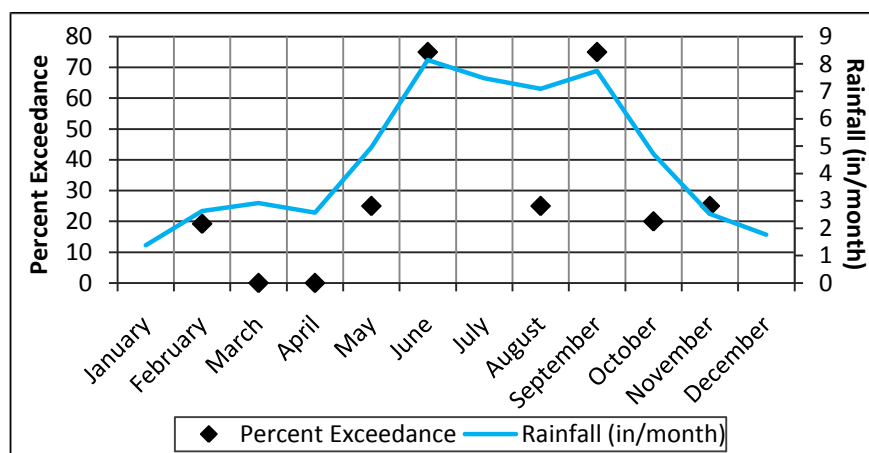


Figure 5.3k. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277A by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

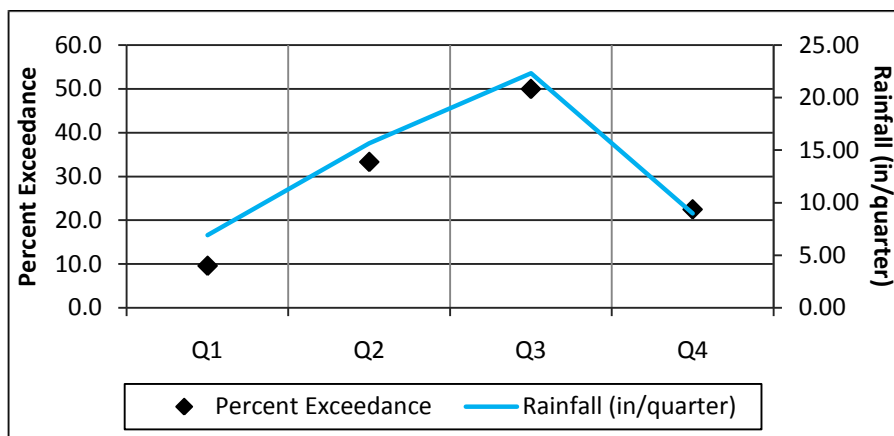


Figure 5.3l. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277A by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

North New River Canal (WBID 3277C)

Monthly exceedance rates show a general positive correlation with monthly rainfall (**Figure 5.3m**). A similar trend was also observed between quarterly rainfall and quarterly exceedance rates (**Figure 5.3n**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3277C high rainfall serves to negatively impact water quality in this basin.

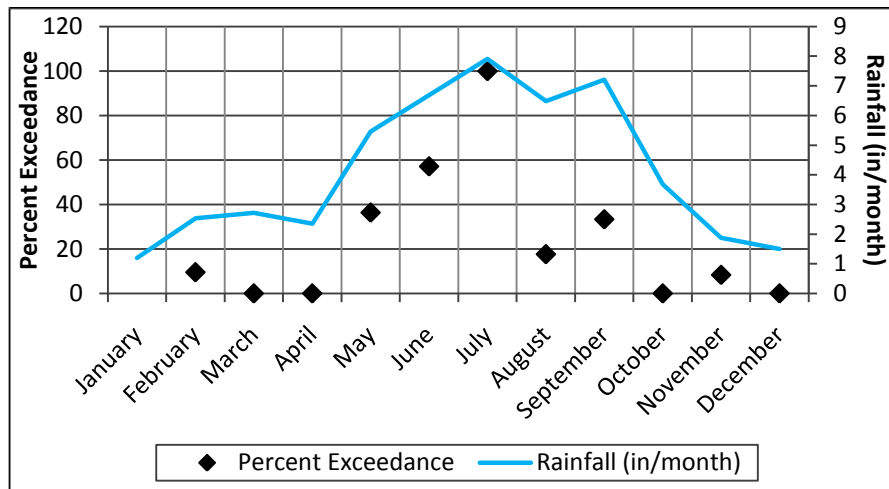


Figure 5.3m. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277C by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

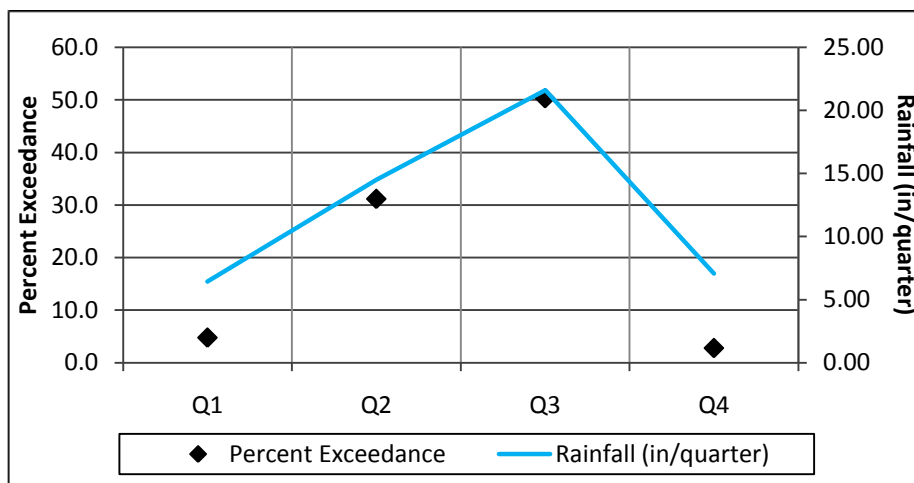


Figure 5.3n. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277C by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Dania Cut-off Canal (WBID 3277E)

Although there is no strong correlation between the monthly exceedance rate and monthly total rainfall, high exceedance rates (above 80%) were indeed observed during the wettest months (**Figure 5.3o**). Exceedance rates generally follow the rainfall pattern on the quarterly basis (**Figure 5.3p**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3277E high rainfall serves to negatively impact water quality in this basin.

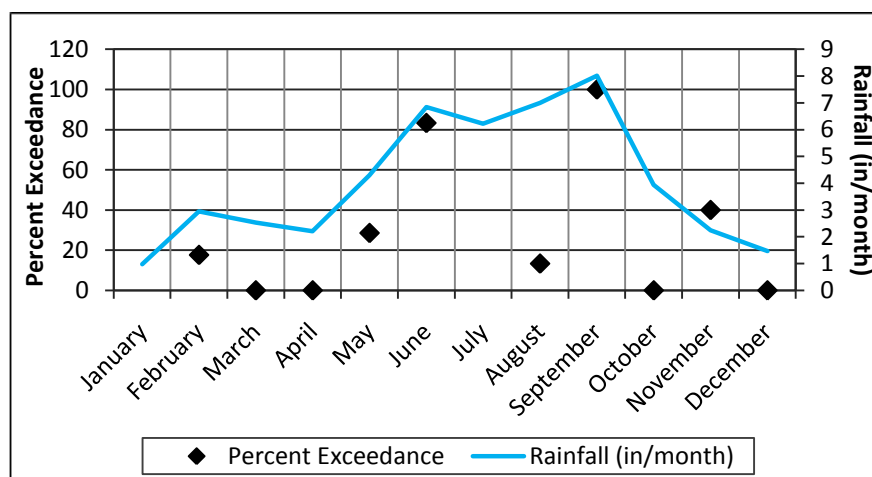


Figure 5.3o. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277E by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

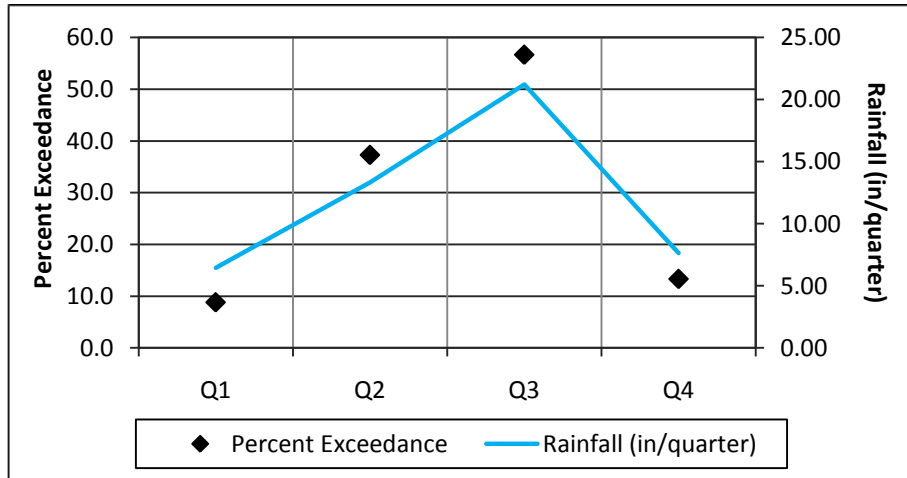


Figure 5.3p. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277E by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

South New River Canal (C-11) (WBID 3279)

The impact of rainfall on monthly and quarterly exceedances in WBID 3279 is distinct. In general, during the Cycle 2 verified period, monthly exceedances closely follow the monthly rainfall pattern (**Figure 5.3q**). Quarterly exceedance rates also follow a very clear trend, with higher exceedances occurring during the wetter months (**Figure 5.3r**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3279 high rainfall serves to negatively impact water quality in this basin.

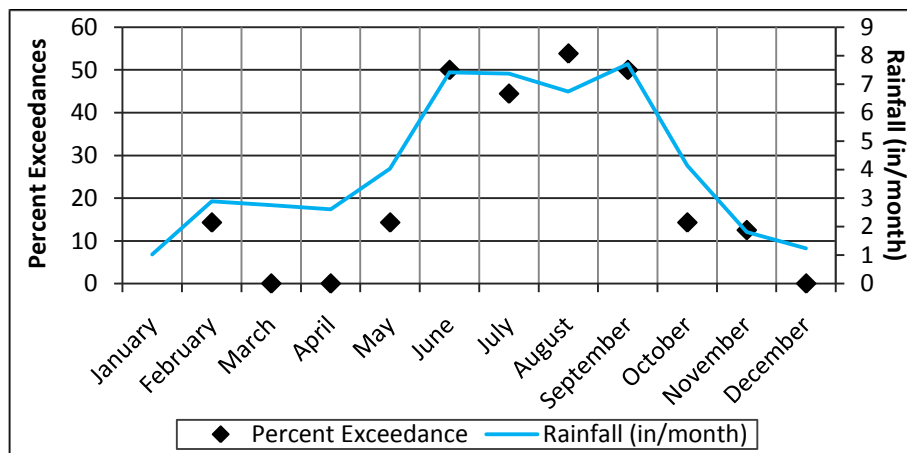


Figure 5.3q. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3279 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

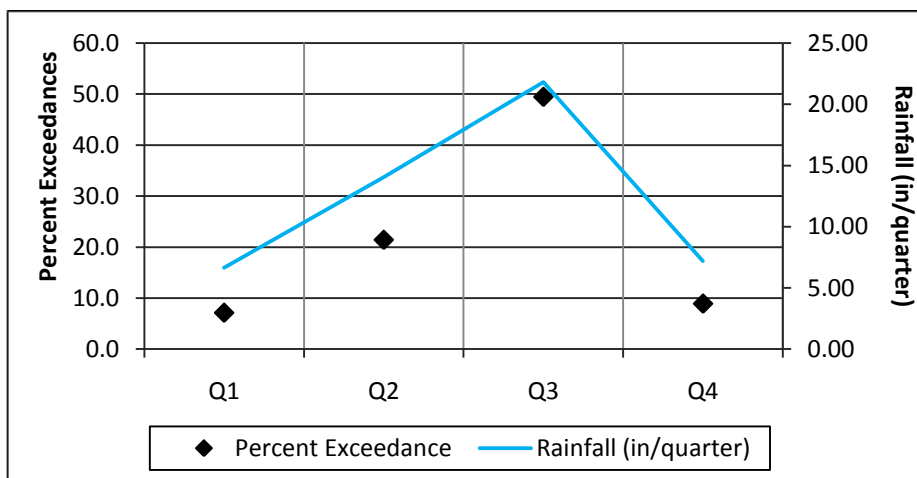


Figure 5.3r. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3279 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

C-11 (East) (WBID 3281)

The impact of rainfall on monthly and quarterly exceedances in WBID 3281 is distinct. Although in a couple of instances non-exceedance rates were recorded during high rainfall events, in general, during the Cycle 2 verified period, higher monthly exceedance rates occurred during months of higher rainfall (**Figure 5.3s**). Quarterly high exceedance rates were recorded mostly during quarters of high rainfall (**Figure 5.3t**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 3281 high rainfall serves to negatively impact water quality in this basin.

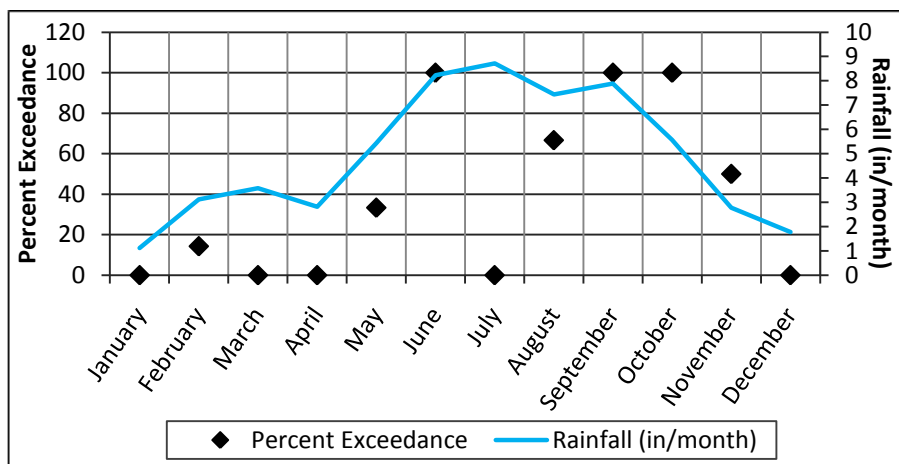


Figure 5.3s. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3281 by Month during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

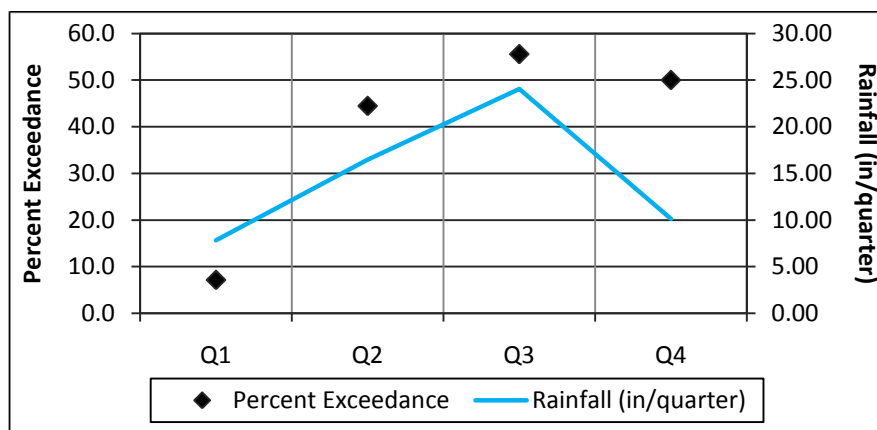


Figure 5.3t. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3281 by Quarter during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

PERIOD OF RECORD TREND

Plotting the entire period of record (historical) fecal coliform data by time for each WBID revealed no significant increasing or decreasing trend for WBIDs 3270 (Prob > F = 0.1226) (**Figure 5.4a**), 3273 (Prob > F = 0.5507) (**Figure 5.4b**), 3276 (Prob > F = 0.3522) (**Figure 5.4c**), 3277A (Prob > F = 0.1089) (**Figure 5.4d**), 3277C (Prob > F = 0.3420) (**Figure 5.4e**), 3277E (Prob > F = 0.3284) (**Figure 5.4f**), and 3281 (Prob > F = 0.3623) (**Figure 5.4g**).

Various stormwater, water supply, and operation and maintenance projects have been completed in Broward County. The South Florida Water Management District (SFWMD) has been working with special drainage districts and various cities and towns on stormwater system improvement projects aimed at water quality and flood control. These projects should result in runoff water quality improvement and potentially impact the fecal coliform concentrations in the canals throughout the County.

Significant increasing trends were observed in period of record fecal coliform data in WBIDs 3274 (Prob < 0.05) (**Figure 5.4h**), 3276A (Prob < 0.05) (**Figure 5.4i**) and 3279 (Prob < 0.05) (**Figure 5.j**).

C-13 East (Middle River) Canal (WBID 3274)

Although no significant increasing or decreasing trend was observed in WBID 3274 during the Cycle 2 verified period, as mentioned above, a significant increasing trend for the entire period of record in the WBID 3274 was observed.

The SFWMD worked with the City of Oakland Park on the Sleepy River Dredging Project, located within WBID 3274. The dredging project reduced the amount of pollution that directly enters into the C-13 Canal. As a result of the dredging, surface water back up onto side streets has been minimized, improving the stormwater entering the canal system during moderate to heavy storm events.

New River (North Fork) (WBID 3276A)

Although no significant increasing or decreasing trend was observed in WBID 3276A during the Cycle 2 verified period, as mentioned above, a significant increasing trend for the entire period of record in the WBID 3276A was observed.

A study was conducted by Solo-Gabriele et al. (2000) in the North Fork to identify the contributing sources to elevated bacteria levels in the river. The study determined that likely sources of bacteria during rainfall events include direct runoff from the river banks, storm sewer inflows and sanitary overflows. In addition, direct runoff may wash contaminated riverbank soils. During periods between rain events, the study determined that soils along the riverbanks were the main contributing source of bacteria. The study also determined that elevated bacteria concentrations were influenced by the high tide in the river.

The SFWMD, Broward County, the City of Fort Lauderdale and various other environmental organizations and community associations have been working together to restore the river. Projects have included: installation of a debris containment boom, debris removal, bank

stabilization projects, dredging, exotic vegetation removal, installation of educational signage, stormwater and sanitary infrastructure improvements, etc. (FAU, 2010).

Although, significant effort has made in the North Fork to restore the river and lower fecal coliform concentrations are recorded in present day than they were historically, elevated fecal coliform concentrations that exceed the state criteria continue to be recorded in the WBID.

South New River Canal (C-11) (WBID 3279)

Although a significant increasing trend was observed in WBID 3279 during the Cycle 2 verified period, as previously mentioned, this statistical significance is being driven by three high values and, therefore, does not accurately represent a specific long term trend, but rather a trend driven by occasional events. If these three data points are removed from the analysis a significant increasing trend is no longer observed. However, as mentioned above, a significant increasing trend for the entire period of record in the WBID 3279 was observed.

The SFWMD has been working with the Broward County Department of Planning and Environmental Protection (DPEP), special drainage districts and various cities and towns on stormwater, water supply, and operation and maintenance projects aimed at water quality and flood control. These projects, located within WBID 3279, could result in runoff water quality improvement and potentially impact the fecal coliform concentrations in the C-11 Canal.

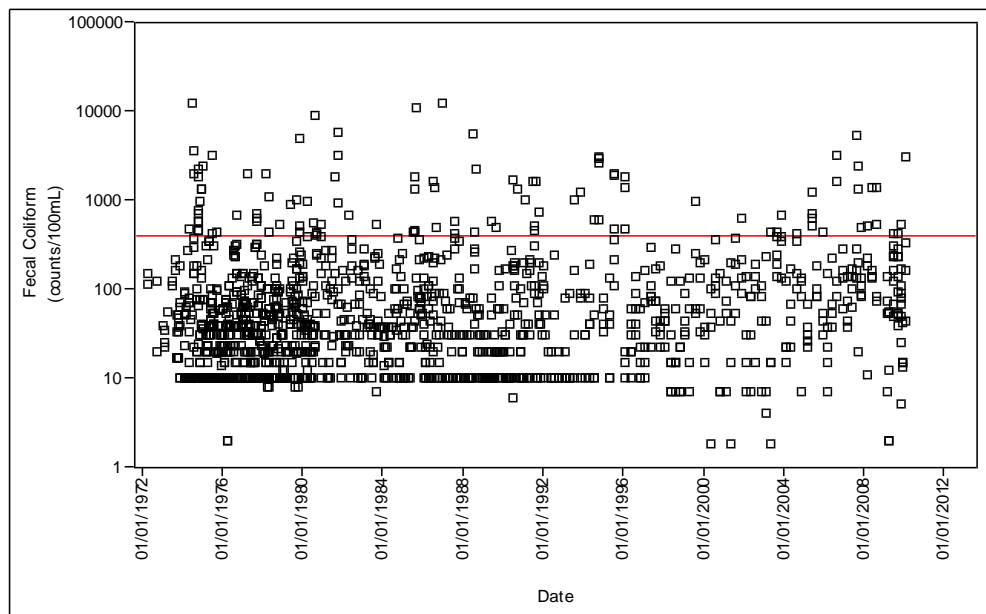


Figure 5.4a. Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

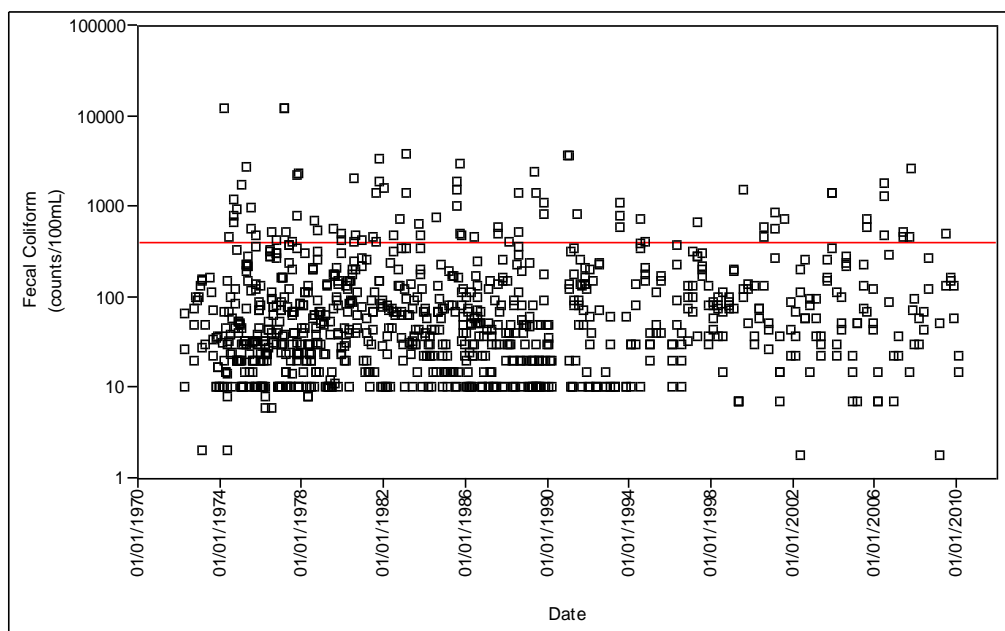


Figure 5.4b. Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

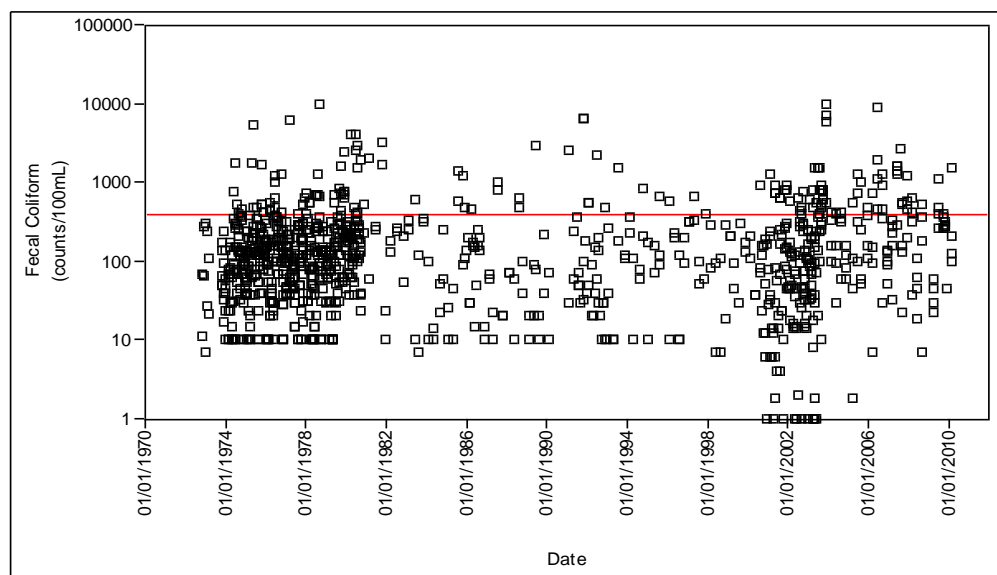


Figure 5.4c. Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

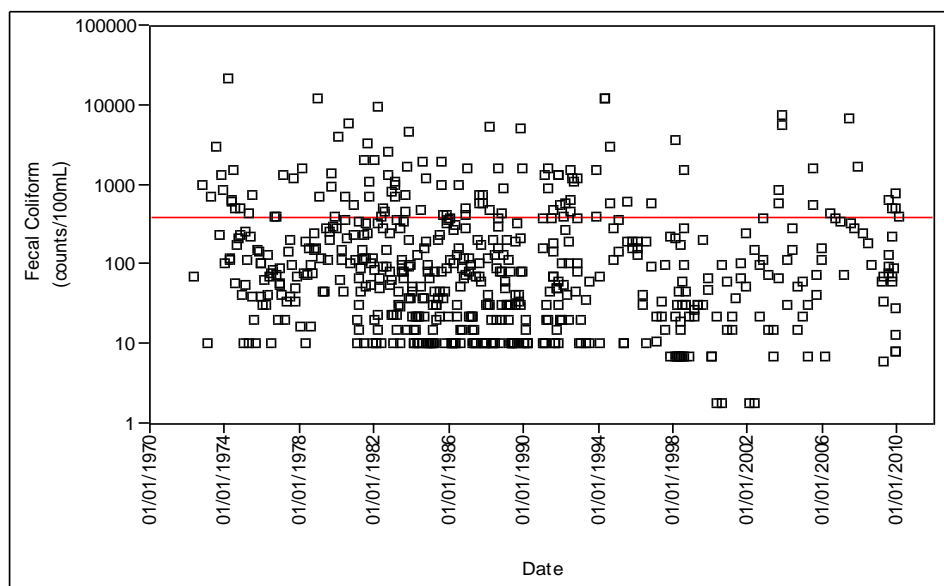


Figure 5.4d. Fecal Coliform Concentration Trends in the C-12 Canal (WBID 3276) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

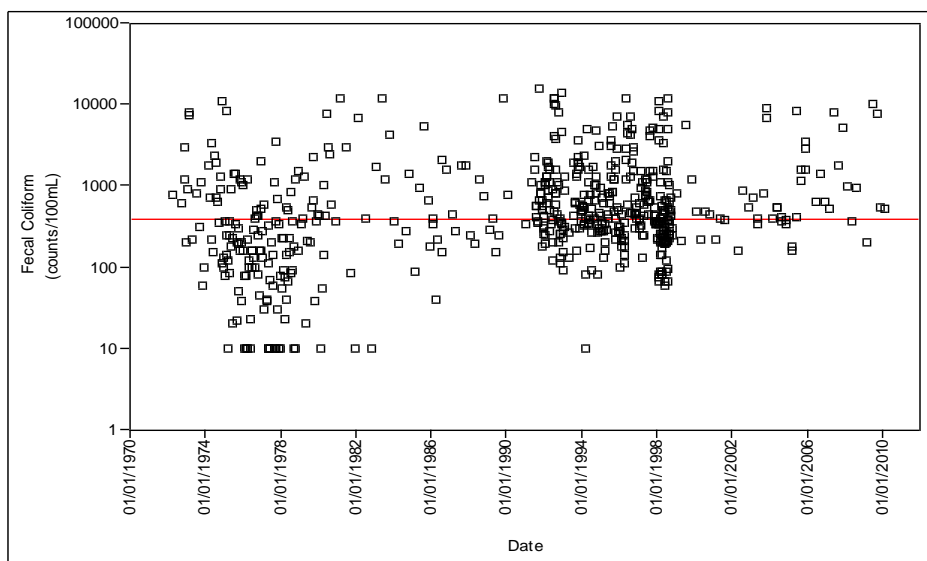


Figure 5.4e. Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

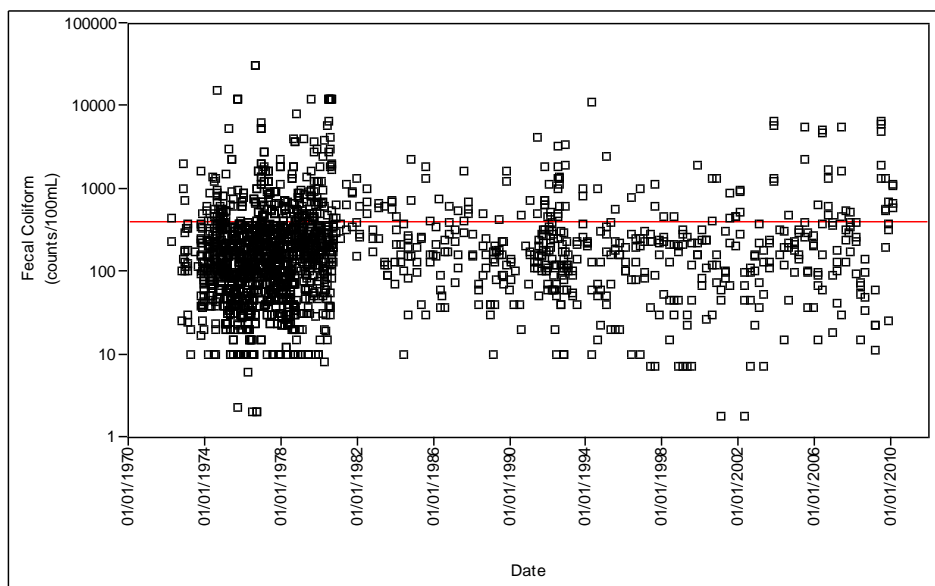


Figure 5.4f. Fecal Coliform Concentration Trends in the South Fork New River (WBID 3277A) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

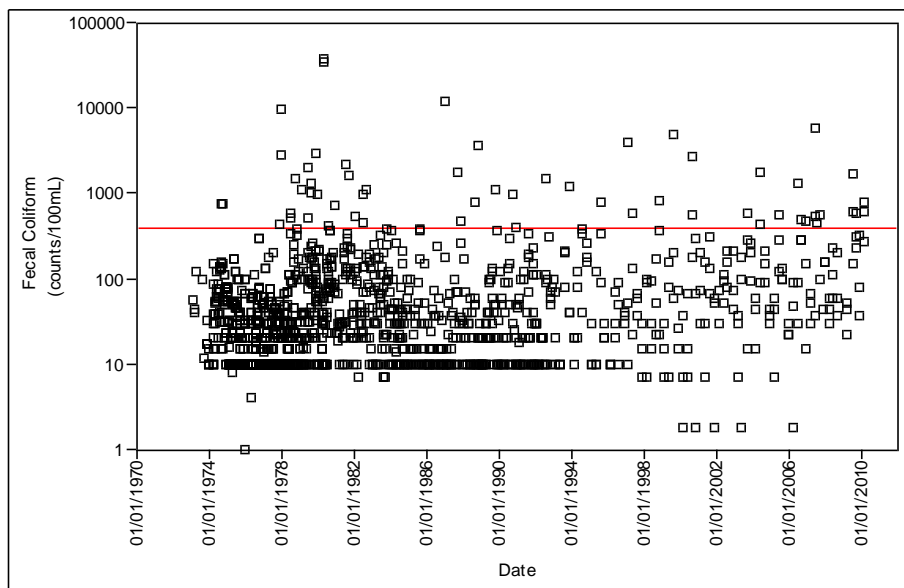


Figure 5.4g. Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) for the Entire Period of Record (1973 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

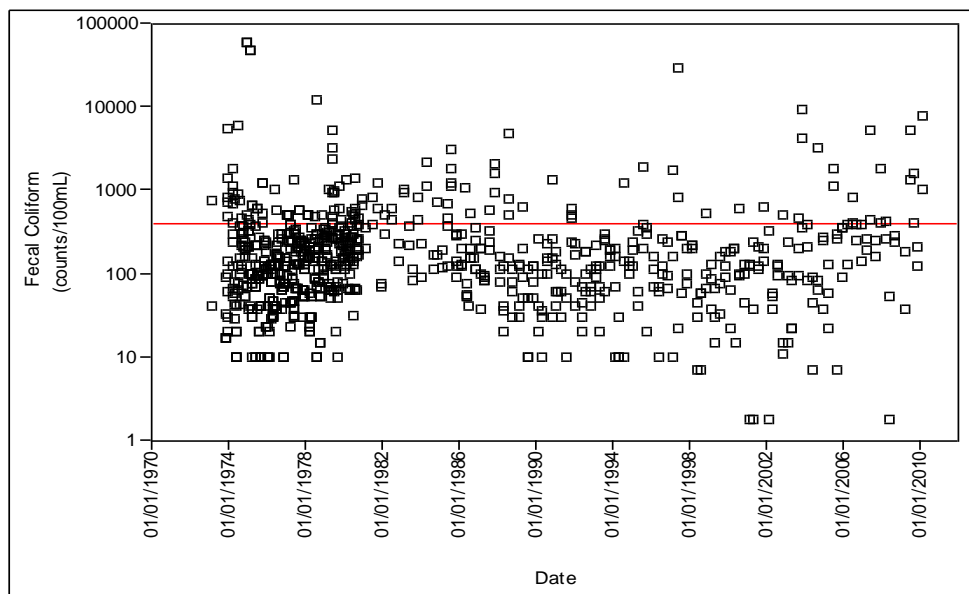


Figure 5.4h. Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) for the Entire Period of Record (1973 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

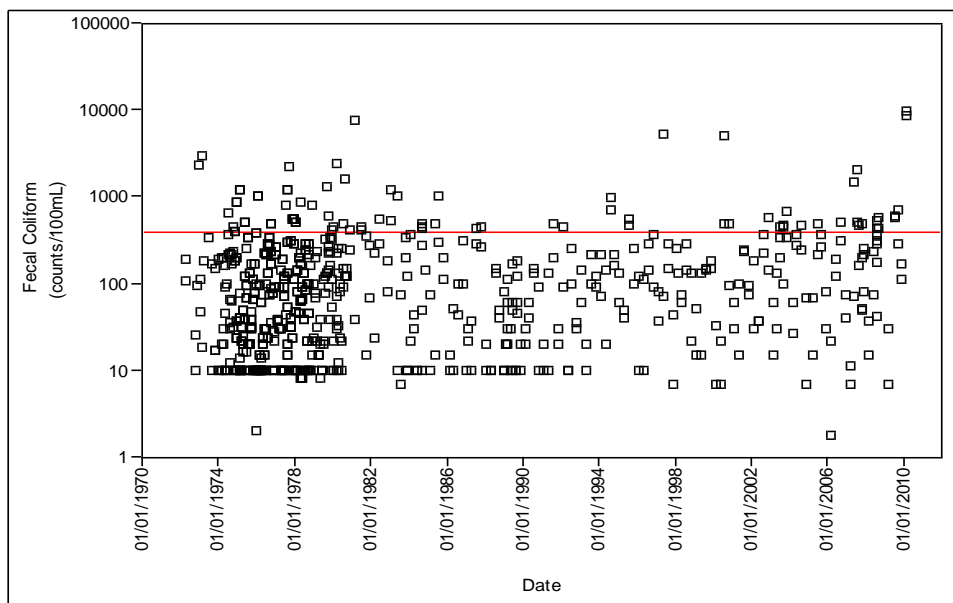


Figure 5.4i. Fecal Coliform Concentration Trends in the South New River Canal (C-11) (WBID 3279) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

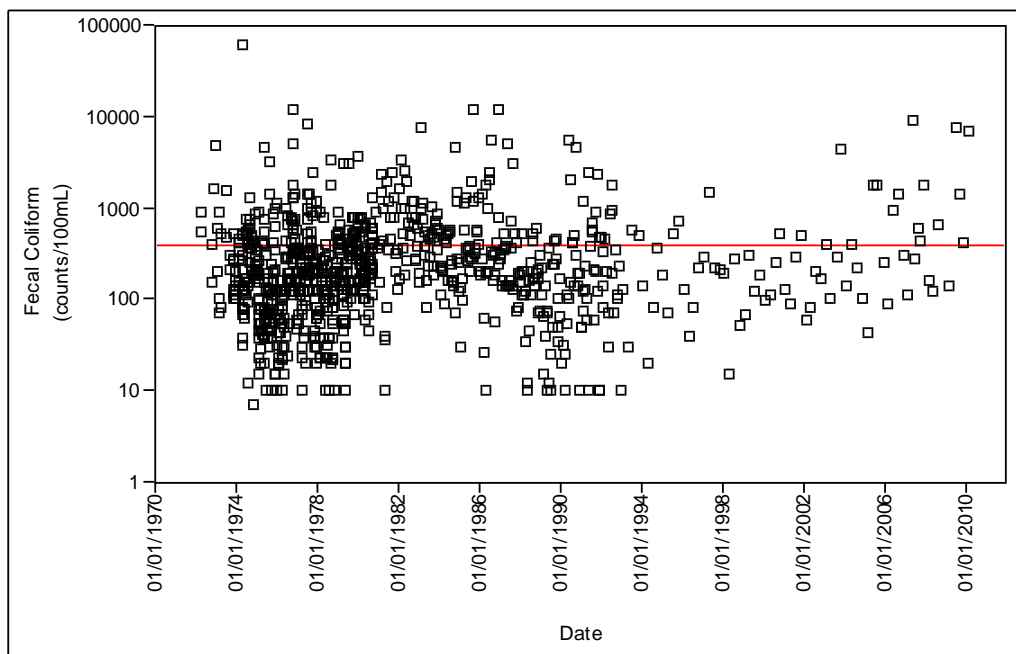


Figure 5.4j. Fecal Coliform Concentration Trends in the C-11 East (South New River) Canal (WBID 3281) for the Entire Period of Record (1972 – 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Spatial Patterns

Fecal coliform data for each WBID from the Cycle 2 verified period (January 1, 2003 through June 30, 2010) were analyzed to detect spatial trends in the data (**Figures 5.5a – 5.5t**). Stations are displayed from west to east (from left to right). **Figure 5.6** shows the spatial distribution of the principal land uses and the locations of the water quality stations within each WBID.

C-14 (Cypress Creek) Canal (WBID 3270)

Fecal coliform concentrations that exceeded the State criteria were observed in 50% (n=8) of the sampling stations within the WBID (**Figure 5.5a** and **Figure 5.5b**). Elevated concentrations were recorded at Stations 21FLBROW6, 21FLBROW8, and 21FLBROW89 (5,200 counts/100mL, 3,000 counts/100mL and 1,400 counts/100mL, respectively), which are located on the C-14 Canal. Elevated concentrations were also recorded at Stations 21FLGW 34111 and 21FLGW 34125 (2,400 counts/100mL and 1,300 counts/100mL, respectively) (**Table 5.5a**). These stations are located in smaller, unnamed, canals within the WBID.

Land use surrounding all stations within the WBID is predominantly medium- and high-density residential.

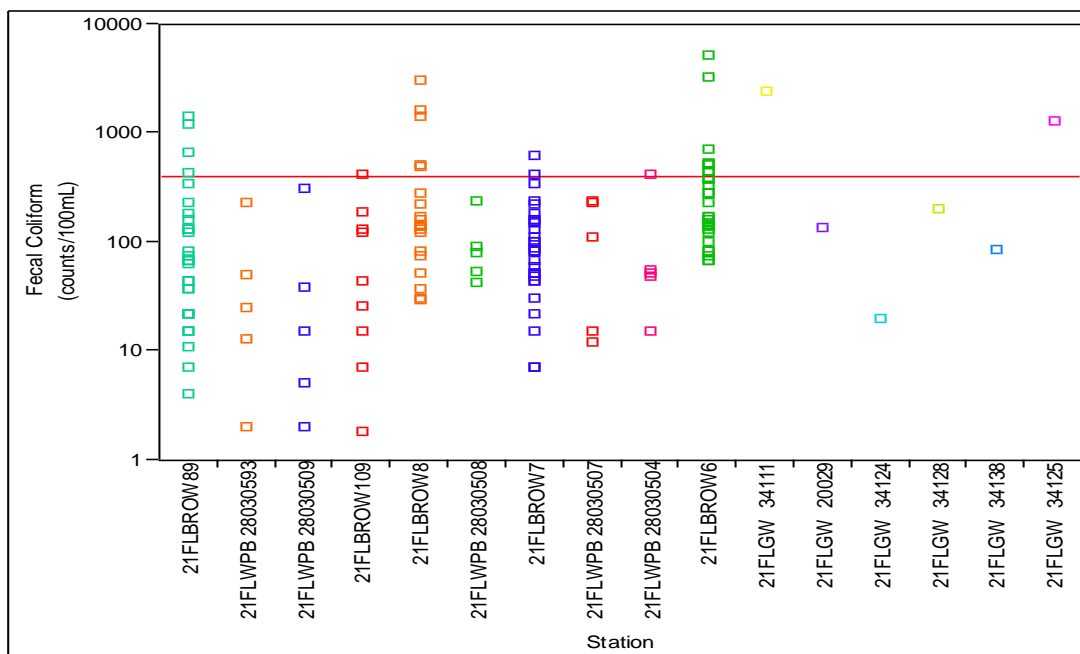


Figure 5.5a. Spatial Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

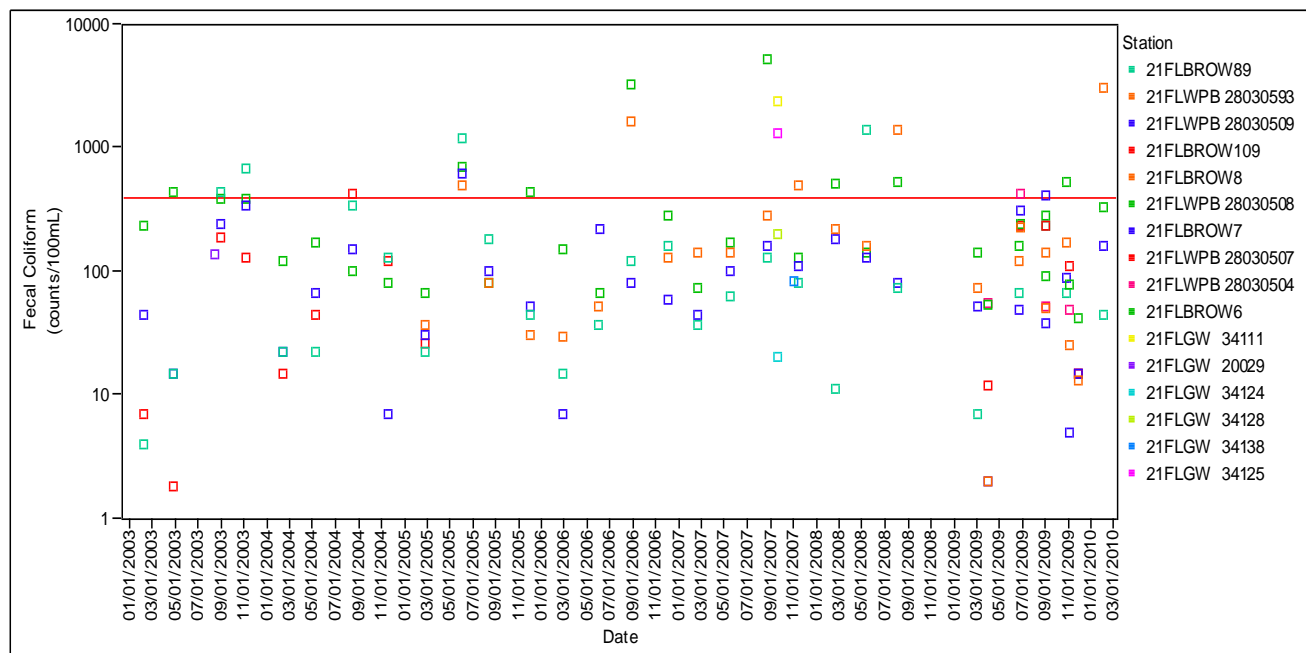


Figure 5.5b. Spatial Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

**Table 5.5a. Station Summary Statistics of Fecal Coliform Data for the
C-14 (Cypress Creek) Canal (WBID 3270) during the Cycle 2
Verified Period (January 1, 2003 through June 30, 2010)**

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW109	2003-2005	9	1.8	420	44	106	1	11.1
21FLBROW6	2003-2010	28	67	5,200	200	538	8	28.6
21FLBROW7	2003-2010	28	7	620	85	129	2	7.1
21FLBROW8	2005-2010	20	29.5	3,000	140	440	5	25.0
21FLBROW89	2003-2010	28	4	1,400	67	201	4	14.3
21FLGW 20029	2003	1	136	136	136	136	0	0.0
21FLGW 34111	2007	1	2400	2,400	2,400	2,400	1	100.0
21FLGW 34124	2007	1	20	20	20	20	0	0
21FLGW 34125	2007	1	1300	1,300	1,300	1,300	1	100
21FLGW 34128	2007	1	200	200	200	200	0	0
21FLGW 34138	2007	1	84	84	84	84	0	0
21FLWPB 28030504	2009	5	15	420	52	118	1	20
21FLWPB 28030507	2009	5	12	234	110	120	0	0
21FLWPB 28030508	2009	5	42	240	78	101	0	0
21FLWPB 28030509	2009	5	2	310	15	74	0	0
21FLWPB 28030593	2009	5	2	228	25	64	0	0

Fecal coliform concentrations that exceeded the State criteria were observed in four of the five sampling stations within the WBID (**Figure 5.5c** and **Figure 5.5d**). Elevated concentrations were recorded at Stations 21FLBROW12, 21FLBROW13, and 21FLBROW14 (1,550 counts/100mL, 1,400 counts/100mL and 1,400 counts/100mL, respectively), located on the C-13 Canal. An elevated fecal coliform concentration (2,600 counts/100mL) was also recorded at Station 21FLGW 34121, located in a smaller, unnamed, canal. Only one sample was collected at this station during the Cycle 2 verified period (**Table 5.5b**).

Land use surrounding all stations within the WBID is predominantly medium- and high-density residential, or commercial.

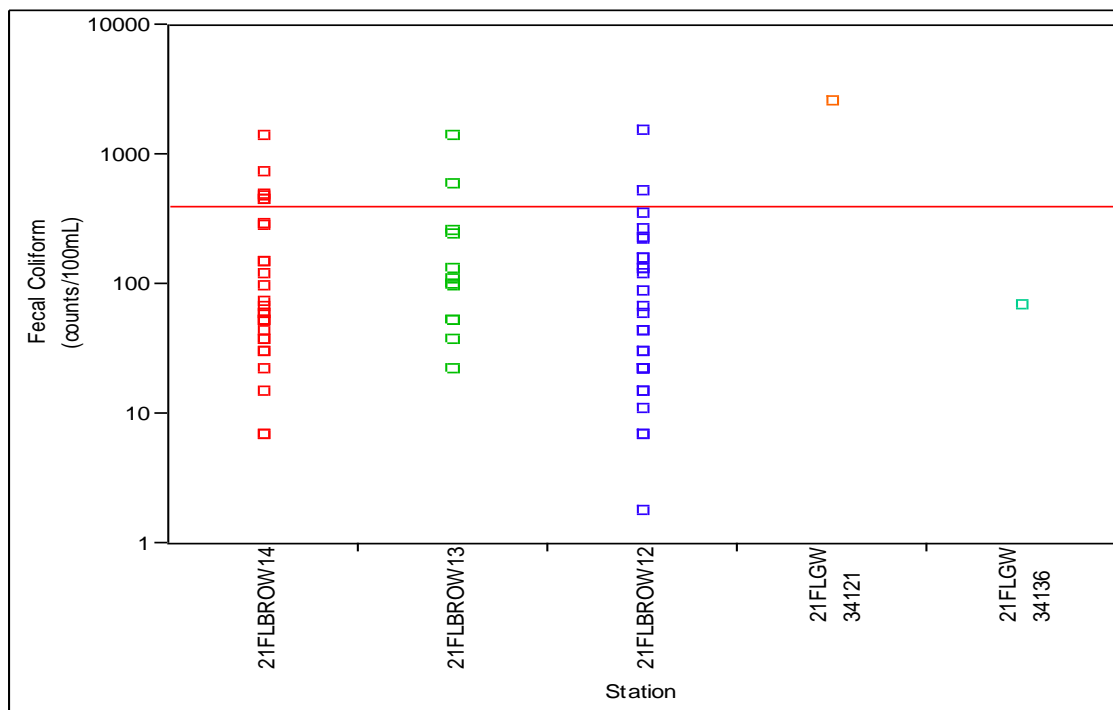


Figure 5.5c. Spatial Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

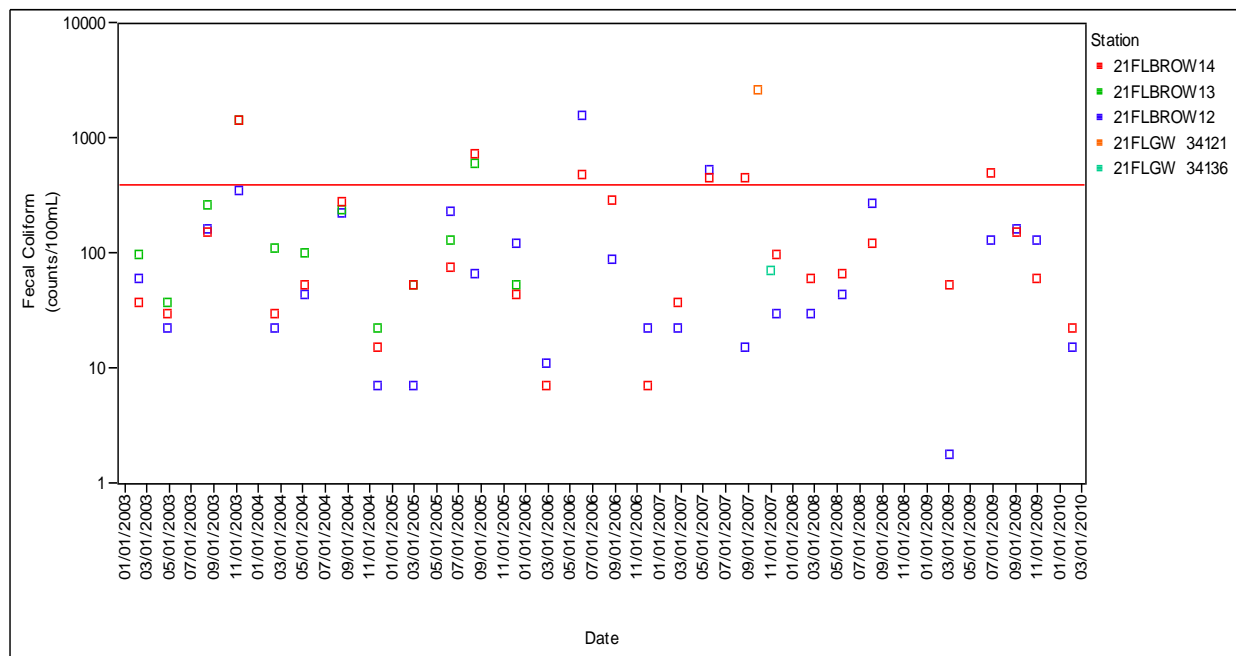


Figure 5.5c. Spatial Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5b. Station Summary Statistics of Fecal Coliform Data for the C-13 West (Middle River) Canal (WBID 3273) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW12	2003-2010	28	1.8	1,550	52	156	2	7.1
21FLBROW13	2003-2005	12	22	1,400	105	257	2	16.7
21FLBROW14	2003-2010	28	7	1,400	63	205	6	21.4
21FLGW 34121	2007	1	2600	2,600	2,600	2,600	1	100.0
21FLGW 34136	2007	1	70	70	70	70	0	0.0

C-13 East (Middle River) Canal (WBID 3274)

Fecal coliform concentrations that exceeded the State criteria were observed in all six sampling stations within the WBID (**Figure 5.5e** and **Figure 5.5f**). Elevated concentrations (greater than 1,000 counts/100mL) were recorded at all stations, with the highest concentration recorded at Station 21FLBROW111 (9,600 counts/100mL), located in the South Fork of the Middle River. High exceedance rates were recorded at Stations 21FLBROW111 (n=28) and 21FLDOH BROWARD31 (n=28) (46.4 % and 37.5%, respectively) – the exceedance rate at Station 21FLGW 33083 is 100%; however, only one sample was collected at this station (**Table 5.5c**).

With the exception of Station 21FLDOH BROWARD31, which is located in a City of Fort Lauderdale Park (George English Park), land use surrounding all stations within the WBID is predominantly medium- and high-density residential, or commercial.

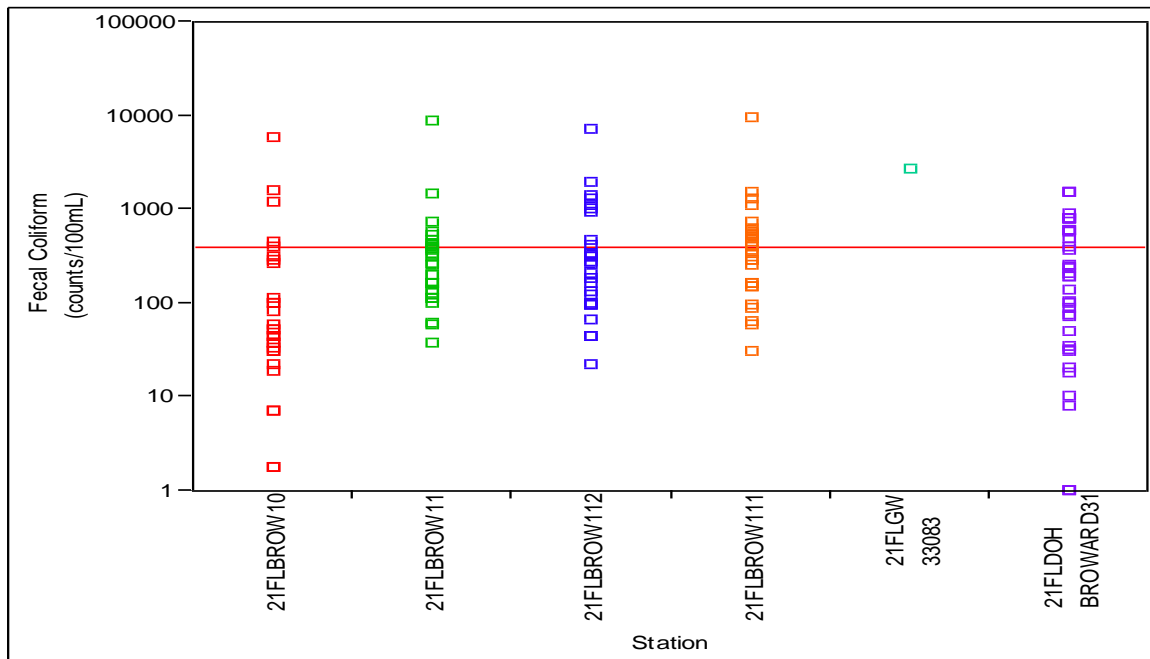


Figure 5.5e. Spatial Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

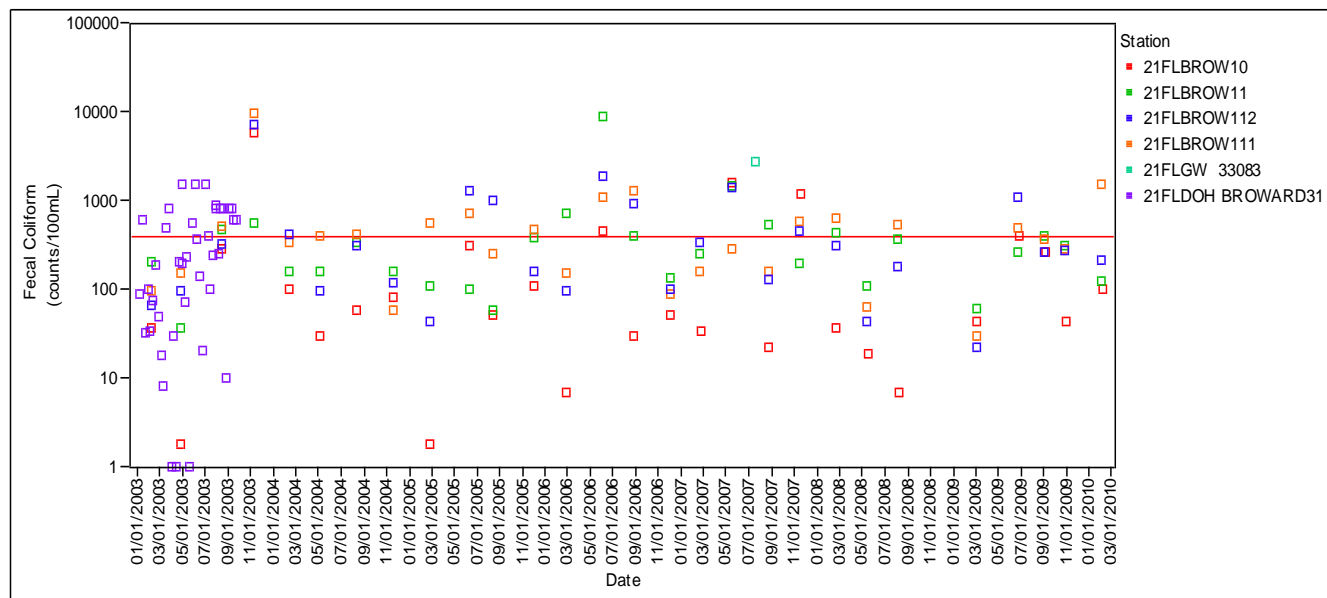


Figure 5.5f. Spatial Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5c. Station Summary Statistics of Fecal Coliform Data for the C-13 East (Middle River) Canal (WBID 3274) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW10	2003-2010	28	1.8	5,800	52	399	4	14.3
21FLBROW11	2003-2010	28	37	8,800	258	617	8	28.6
21FLBROW111	2003-2010	28	30	9,600	380	760	13	46.4
21FLBROW112	2003-2010	28	22	7,200	265	674	9	32.1
21FLDOH BROWARD31	2003	40	1	1,500	221	398	15	37.5
21FLGW 33083	2007	1	2700	2,700	2,700	2,700	1	100.0

C-12 Canal (WBID 3276)

Fecal coliform concentrations that exceeded the State criteria were observed in four of the seven sampling stations within the WBID (**Figure 5.5g** and **Figure 5.5h**). High exceedance rates, at stations with a sample size greater than one, were recorded at Stations 21FLBROW17 (n=28), 21FLBROW18 (n=12) and 21FLWPB 42009011 (n=5) (28.6 %, 16.7%, and 40%, respectively) – the exceedance rate at Station 21FLGW 20027 is 100%; however, only one sample was collected at this station. The most elevated fecal coliform concentrations in the WBID were recorded at Stations 21FLBROW17 (7,400 counts/100mL) and 21FLBROW18 (5,600 count/100mL), both located on the C-12 Canal (**Table 5.5d**).

Land use surrounding all stations within the WBID is predominantly medium- and high-density residential, or commercial.

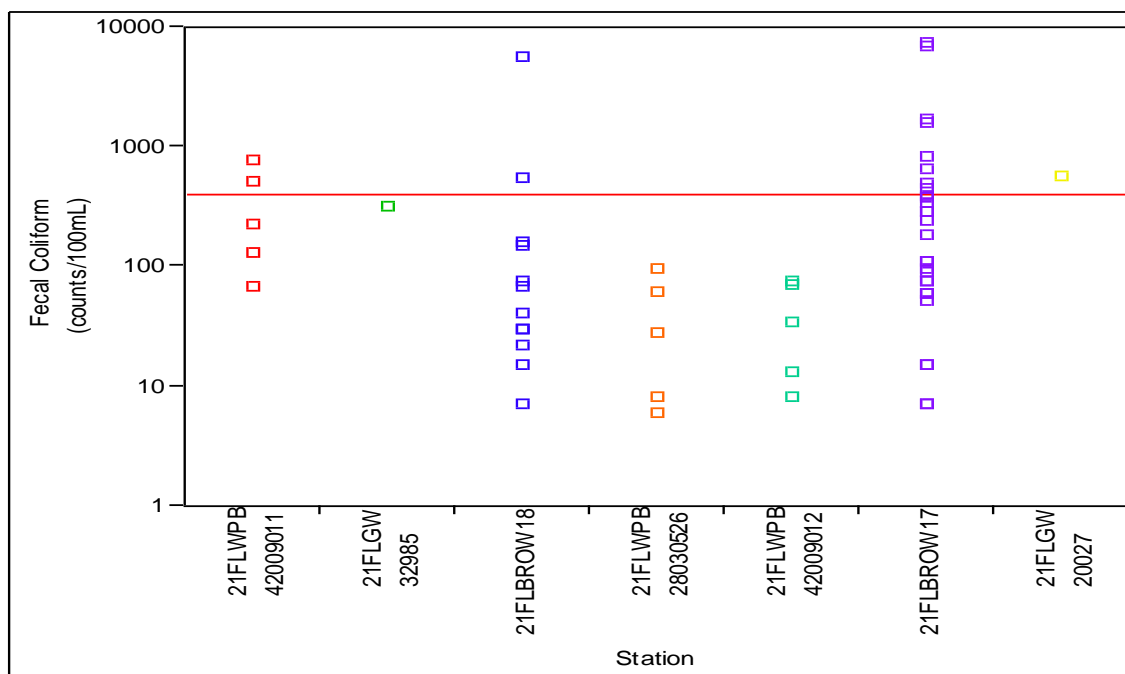


Figure 5.5g. Spatial Fecal Coliform Concentration Trends in the C-12 Canal (WBID 3276) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

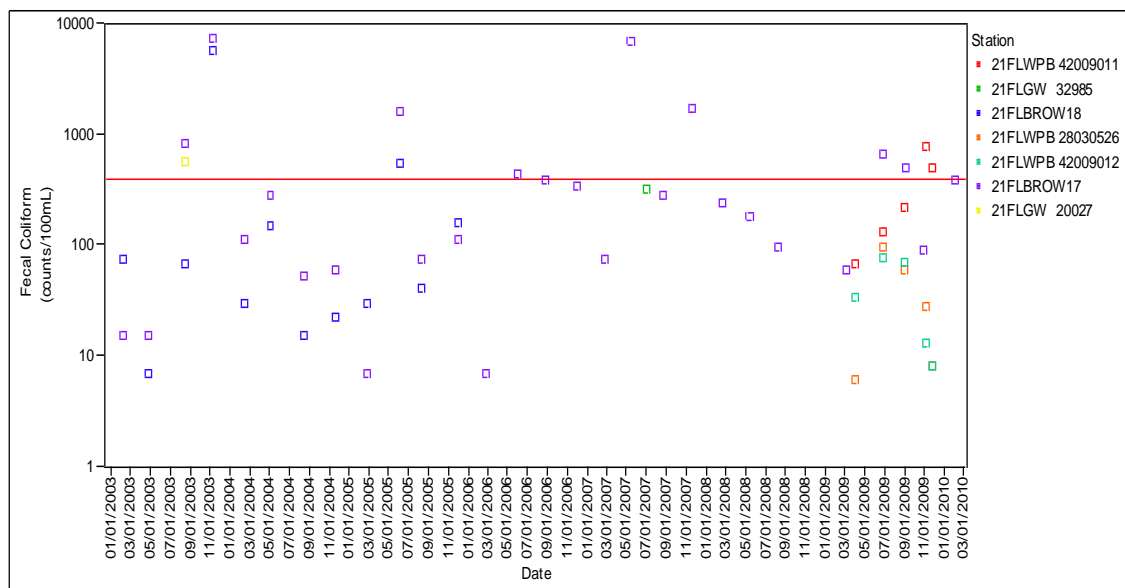


Figure 5.5h. Spatial Fecal Coliform Concentration Trends in the C-12 Canal (WBID 3276) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5d. Station Summary Statistics of Fecal Coliform Data for the C-12 Canal (WBID 3276) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW17	2003-2010	28	7	7,400	210	813.1	8	28.6
21FLBROW18	2003-2005	12	7	5,600	54	561.3	2	16.7
21FLGW 20027	2003	1	570	570	570	570	1	100.0
21FLGW 32985	2007	1	320	320	320	320	0	0.0
21FLWPB 28030526	2009	5	6	94	28	39.2	0	0.0
21FLWPB 42009011	2009	5	68	764	220	336.6	2	40.0
21FLWPB 42009012	2009	5	8	76	34	40.2	0	0.0

New River (North Fork) (WBID 3276A)

Fecal coliform concentrations that exceeded the State criteria were observed at both sampling stations within the WBID (**Figure 5.5i** and **Figure 5.5j**), both located on the North Fork New River. The highest exceedance rate and fecal coliform concentration in the WBID were recorded at Station 21FLBROW16 (76% and 10,000 counts/100mL) (**Table 5.5e**).

Land use surrounding both stations within the WBID is predominantly medium- and high-density residential, or commercial.

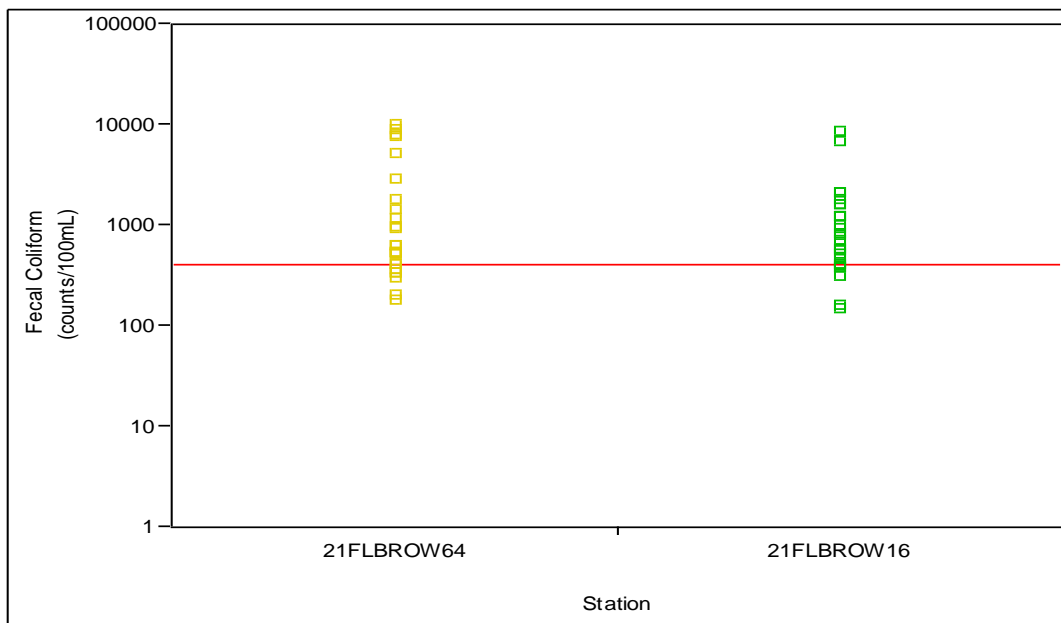


Figure 5.5i. Spatial Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

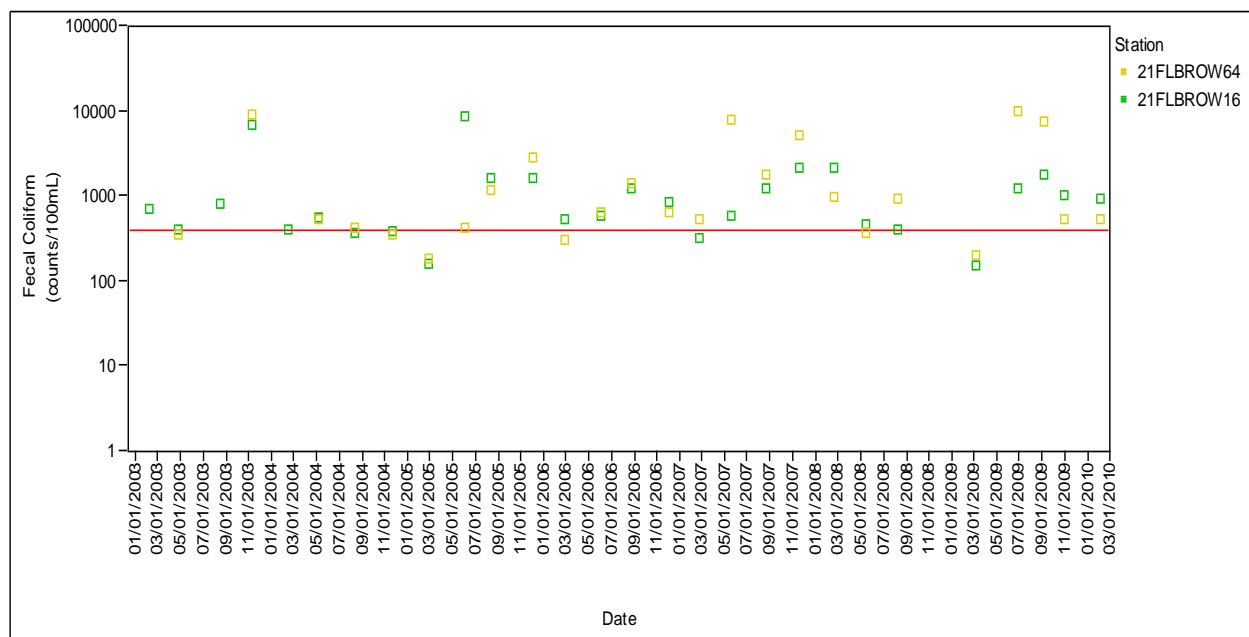


Figure 5.5j. Spatial Fecal Coliform Concentration Trends in New River (North Fork) (WBID 3276A) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5e. Station Summary Statistics of Fecal Coliform Data for the New River (North Fork) (WBID 3276A) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW16	2003-2010	28	150	8,400	750	1,340.4	20	71.4
21FLBROW64	2003-2010	25	180	10,000	620	2,175.6	19	76.0

New River Canal (South) (WBID 3277A)

Fecal coliform concentrations that exceeded the State criteria were observed at four of the five sampling stations within the WBID data (**Figure 5.5k** and **Figure 5.5l**); these four stations are located on the South Fork New River. Station 21 FLGW 34132 is located on an unnamed canal. The highest fecal coliform concentration was recorded at Station 21FLBROW19 (6,400 counts/100mL). However, the highest exceedance rate was recorded at Station 21FLBROW20, where the highest concentration was 4,800 counts/100mL (**Table 5.5f**).

With the exception of Station 21FLBROW15, which is surrounded predominantly by commercial land, land use surrounding all stations within the WBID is predominantly medium- and high-density residential.

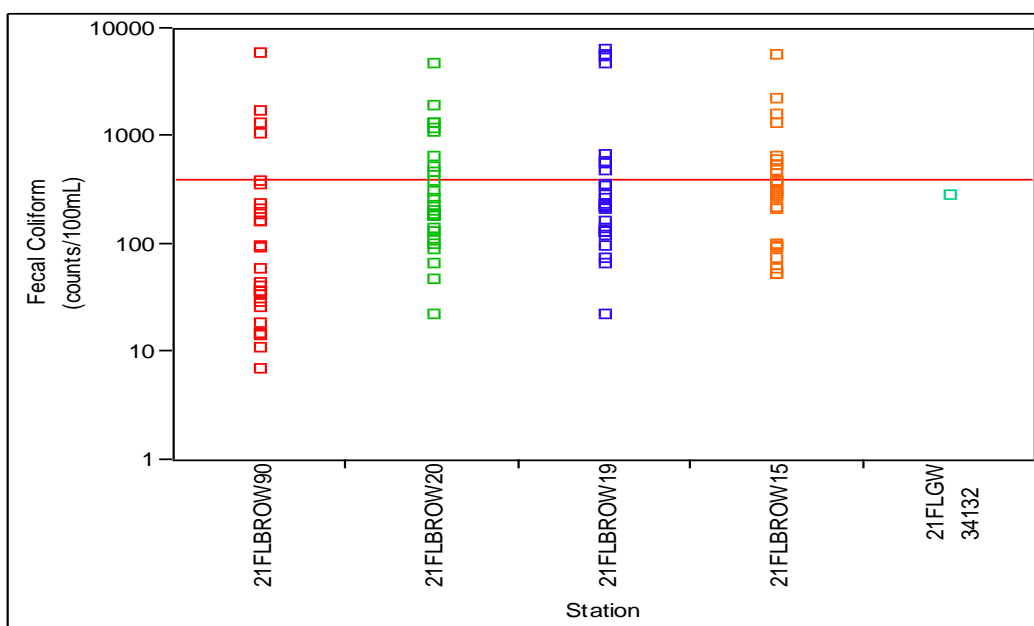


Figure 5.5k. Spatial Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

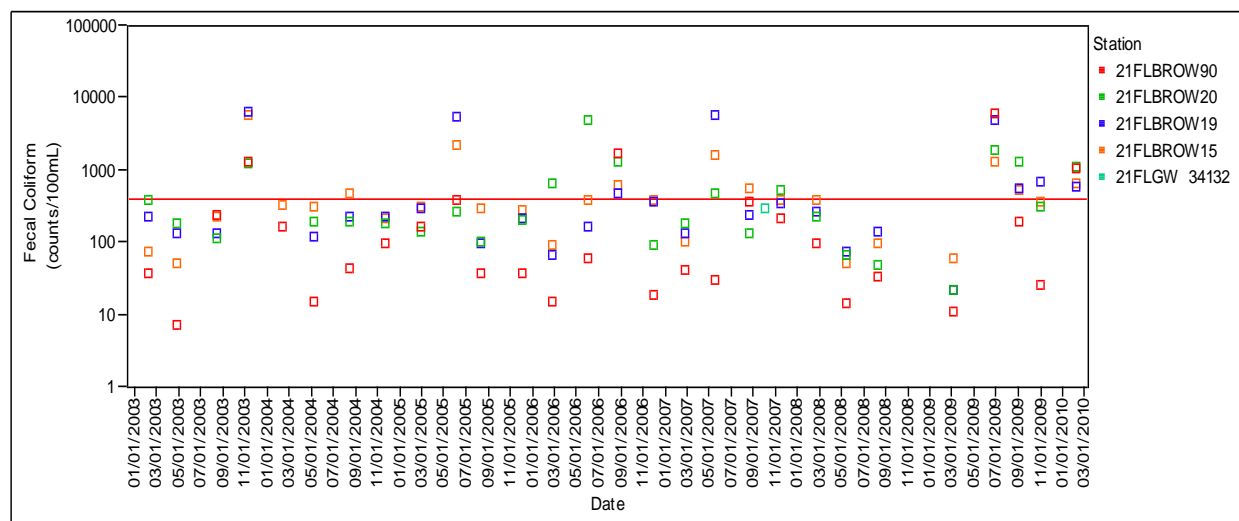


Figure 5.5I. Spatial Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5f. Station Summary Statistics of Fecal Coliform Data for the New River Canal (South) (WBID 3277A) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW15	2003-2010	28	52	5,800	345	645.9	9	32.1
21FLBROW19	2003-2010	27	22	6,400	230	1,034.4	8	29.6
21FLBROW20	2003-2010	27	22	4,800	200	600.6	9	33.3
21FLBROW90	2003-2010	28	7	6,000	51.5	442.3	4	14.3
21FLGW 34132	2007	1	290	290	290	290.0	0	0.0

North New River Canal (WBID 3277C)

Fecal coliform concentrations that exceeded the State criteria were observed in all three of the four sampling stations within the WBID (**Figure 5.5m** and **Figure 5.5n**). High exceedance rates were recorded at Stations 21FLBROW21 (n=28) and 21FLBROW22 (n=27) (32.1 % and 22.2%, respectively), with the highest fecal coliform concentration recorded at Station 21FLBROW22 (5,800 counts/100mL). The exceedance rate at Station 21FLGW 32963 is 100%; however, only one sample was collected at this station (**Table 5.5g**). All stations in this WBID are located on the North New River Canal.

With the exception of Station 21FLBROW23 (n=28), which is surrounded predominantly by industrial land and roads and highways, land use surrounding all stations within the WBID is predominantly medium- and high-density residential, and commercial.

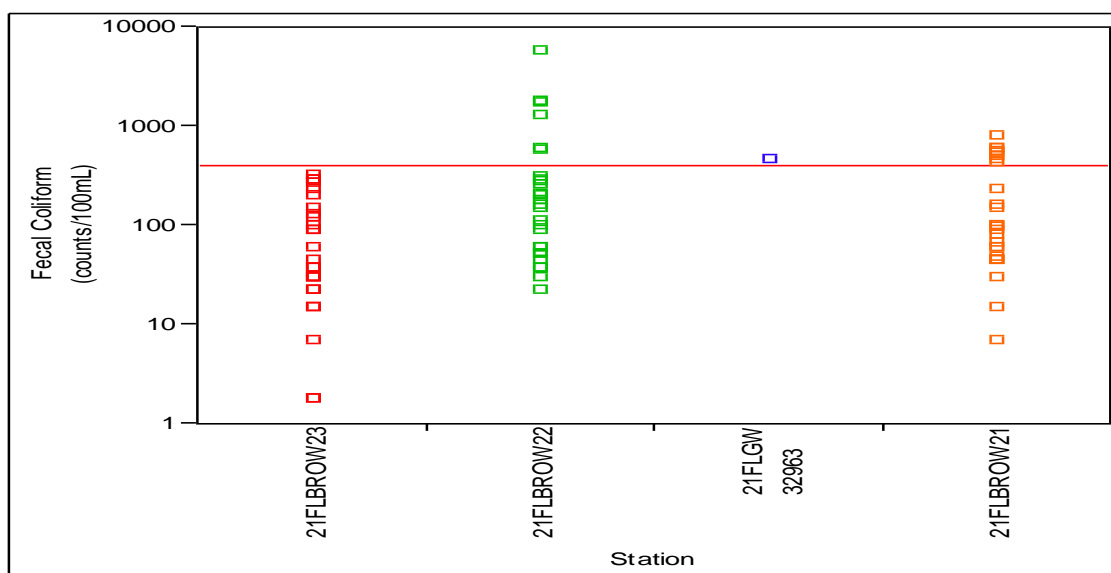


Figure 5.5m. Spatial Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

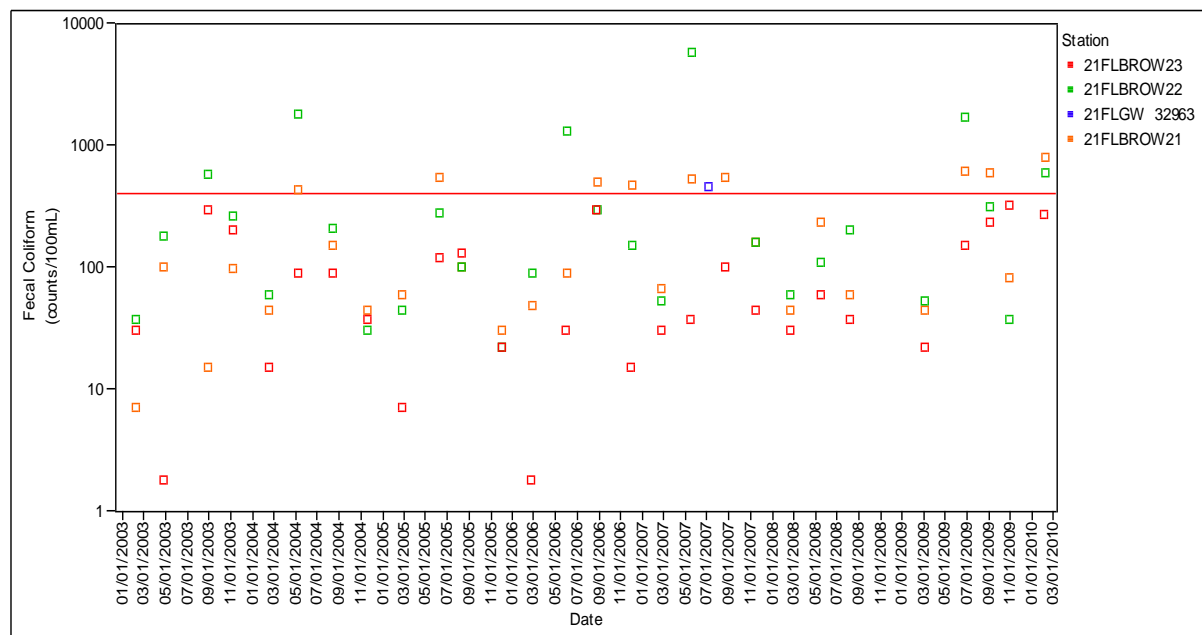


Figure 5.5n. Spatial Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5g. Station Summary Statistics of Fecal Coliform Data for the North New River Canal (WBID 3277C) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW21	2003-2010	28	7	800	98	232.0	9	32.1
21FLBROW22	2003-2010	27	22	5800	160	537.4	6	22.2
21FLBROW23	2003-2010	28	1.8	320	40.5	96.31	0	0.0
21FLGW 32963	2007	1	460	460	460	460	1	100.0

Dania Cut-off Canal (WBID 3277E)

Fecal coliform concentrations that exceeded the State criteria were observed in two of the three sampling stations within the WBID (**Figure 5.5o** and **Figure 5.5p**). The highest exceedance rate (39.3%) and highest fecal coliform concentration (9,400 counts/100mL) in the WBID were recorded at Station 21FLBROW24 (n=28). Station 21FLBROW26 (n=28) had an exceedance rate of 25% and a high fecal coliform concentration of 5,200 counts/100mL (**Table 5.5h**). Both stations are located on the Dania Cut-off Canal.

The land use surrounding Station 21FLBROW47 (n=11) is predominantly mangrove swamps, open area and Port Everglades. Land use surrounding Stations 21FLBROW24 and 21FLBROW26 is predominantly commercial, with some medium- and high-density residential areas.

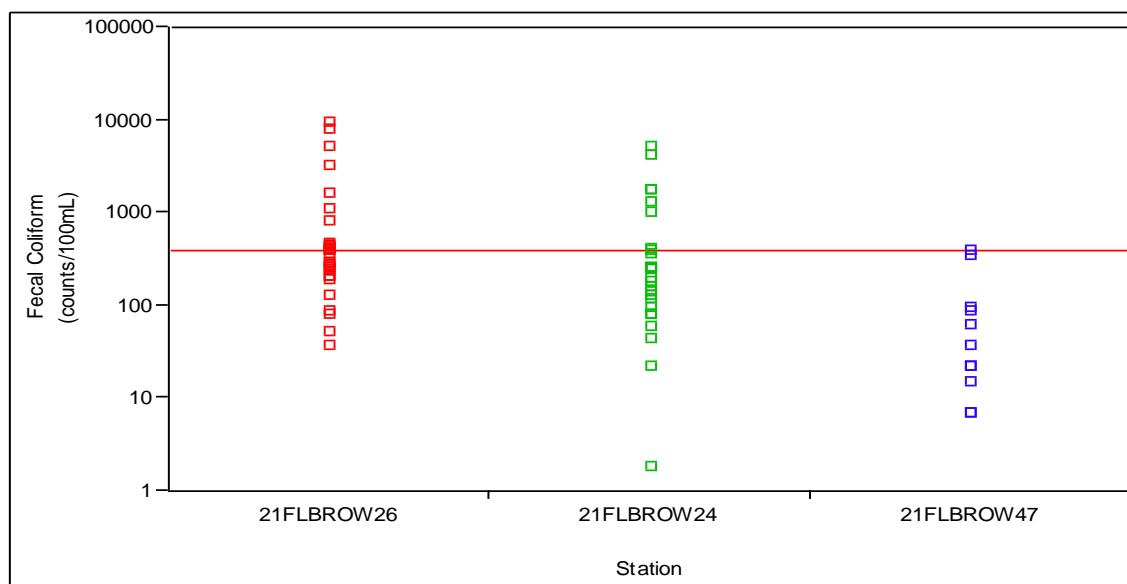


Figure 5.5o. Spatial Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

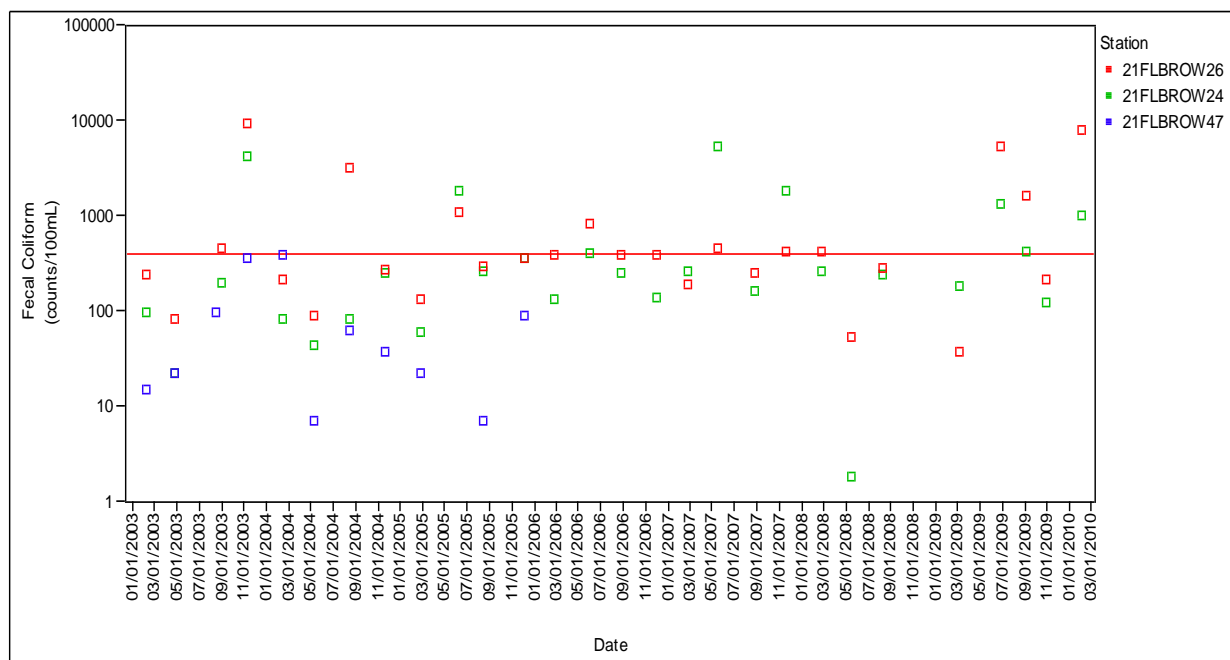


Figure 5.5p. Spatial Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5h. Station Summary Statistics of Fecal Coliform Data for the Dania Cut-off Canal (WBID 3277E) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is an eight-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the maximum count/100mL, Column 5 lists the mean count, Column 6 lists the median count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW24	2003-2010	28	1.8	5,200	245	689.5	7	25.0
21FLBROW26	2003-2010	28	37	9,400	375	1,240.3	11	39.3
21FLBROW47	2003-2005	11	7	390	37	99.8	0	0

South New River Canal (C-11) (WBID 3279)

Water quality samples for fecal coliform data for this WBID were collected from 20 sampling stations; four of these stations are located in waterbodies not directly connected with the C-11 Canal. Stations 21FLGW 17429, 21FLGW 32968 and 21FLGW 35003 are located on the L-35 (North New River Canal) and Station 21FLGW 34115 is located on the L-37 Canal. As a result, analysis for this WBID included only stations located on, or on waterbodies directly connected to, the C-11 Canal.

Fecal coliform concentrations that exceeded the State criteria were observed in 37% (n=6) of the sampling stations within the WBID (**Figure 5.5q** and **Figure 5.5r**). High exceedance rates were recorded at Stations 21FLBROW28 (n=28) and 21FLBROW29 (n=28) (35.7% and 17.9%, respectively), with the highest fecal coliform concentration recorded at Station 21FLBROW29 (9,800 counts/100mL). The exceedance rate at Stations 21FLGW 32965, 21FLGW 34116, 21FLSFWMC1102.0TS and 21FLSFWMC1104.6TS is 100%; however, only one sample was collected at each of these stations (**Table 5.5i**).

The land use surrounding Station 21FLBROW28 is predominantly wetland and upland non-forested. Land use surrounding the remaining stations in the WBID is primarily residential (low, medium and high), with some agriculture and forested areas.

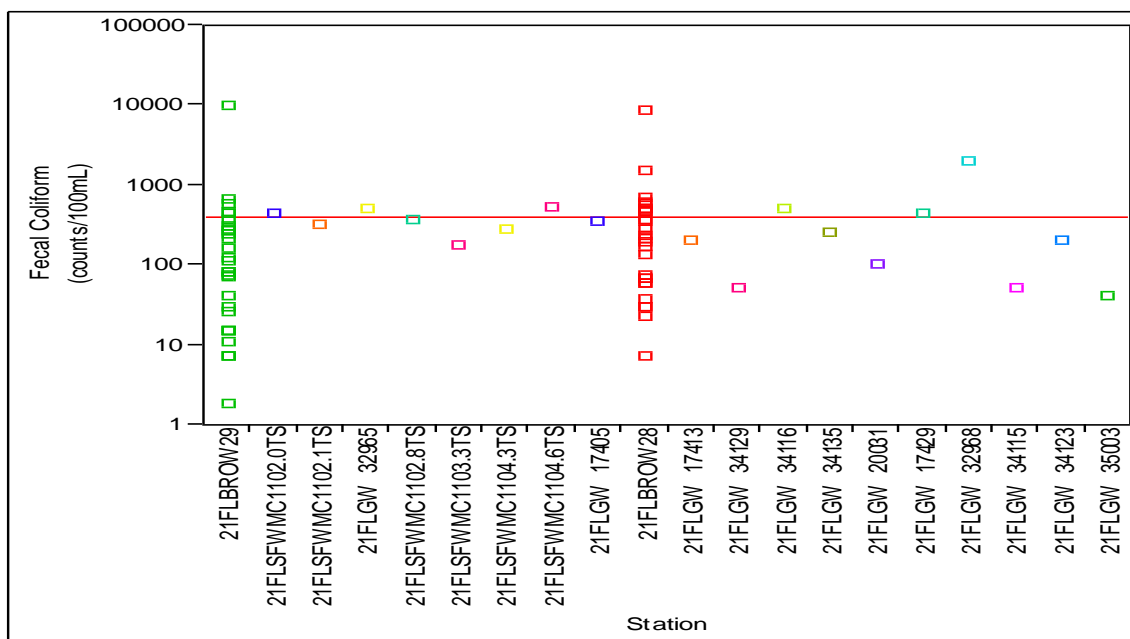


Figure 5.5q. Spatial Fecal Coliform Concentration Trends in South New River Canal (C-11) (WBID 3279) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

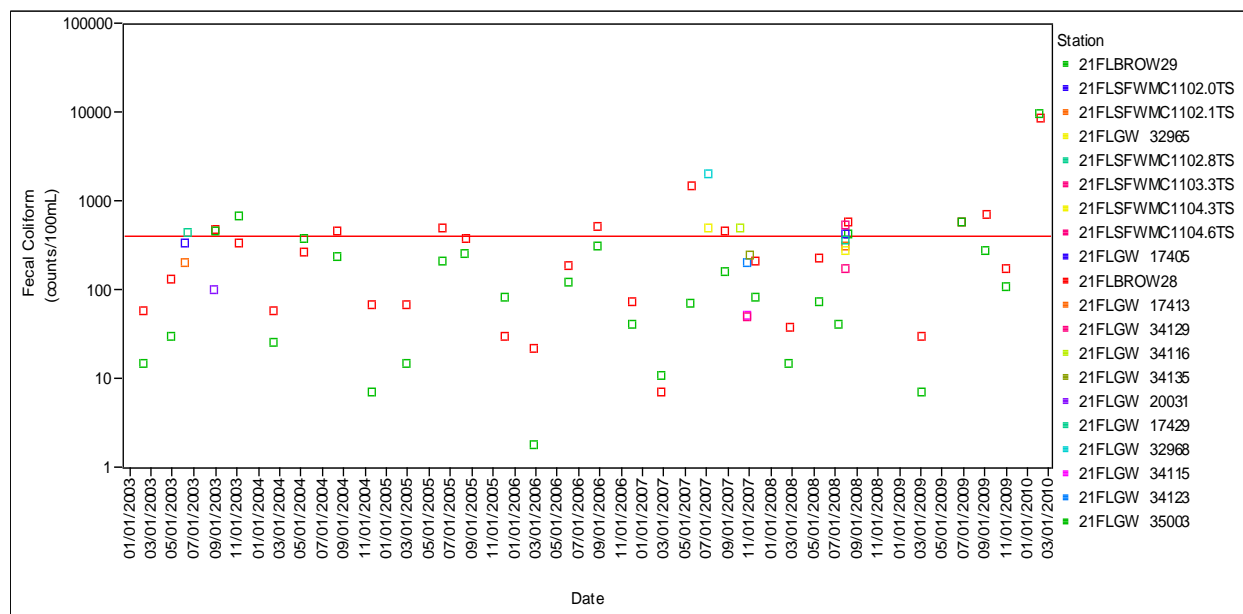


Figure 5.5r. Spatial Fecal Coliform Concentration Trends in the South New River Canal (C-11) (WBID 3279) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

**Table 5.5i. Station Summary Statistics of Fecal Coliform Data for the
South New River Canal (C-11) (WBID 3279) during the Cycle
2 Verified Period (January 1, 2003 through June 30, 2010)**

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW28	2003-2010	28	7	8,400	220	590.1	10	35.7
21FLBROW29	2003-2010	28	1.8	9,800	95.5	516.4	5	17.9
21FLGW 17405	2003	1	340	340	340	340	0	0
21FLGW 17413	2003	1	200	200	200	200	0	0
21FLGW 17429	2003	1	440	440	440	440	1	100
21FLGW 20031	2003	1	100	100	100	100	0	0
21FLGW 32965	2007	1	500	500	500	500	1	100
21FLGW 32968	2007	1	2000	2,000	2,000	2,000	1	100
21FLGW 34115	2007	1	51	51	51	51	0	0
21FLGW 34116	2007	1	490	490	490	490	1	100
21FLGW 34123	2007	1	200	200	200	200	0	0
21FLGW 34129	2007	1	50	50	50	50	0	0
21FLGW 34135	2007	1	250	250	250	250	0	0
21FLGW 35003	2008	1	41	41	41	41	0	0
21FLSFWMC1102.0TS	2008	1	430	430	430	430	1	100
21FLSFWMC1102.1TS	2008	1	310	310	310	310	0	0
21FLSFWMC1102.8TS	2008	1	360	360	360	360	0	0
21FLSFWMC1103.3TS	2008	1	172	172	172	172	0	0
21FLSFWMC1104.3TS	2008	1	280	280	280	280	0	0
21FLSFWMC1104.6TS	2008	1	530	530	530	530	1	100

C-11 (East) (WBID 3281)

Fecal coliform concentrations that exceeded the State criteria were observed in two of the three sampling stations within the WBID (**Figure 5.5s** and **Figure 5.5t**). The highest exceedance rate was recorded at Station 21FLGW 34119 (100%); however, only one sample was collected at this station. Stations 21FLBROW27, the station with the greatest number of samples in the WBID (n=28), has an exceedance rate of 46.4% and a high fecal coliform concentration of 9,100 counts/100mL (**Table 5.5j**). Stations 21FLBROW27 is located on the C-12 Canal; Station 21FLGW 34119 is located on an unnamed secondary/tertiary canal.

The land use surrounding Station 21FLGW 34119 is predominantly medium-density residential. Land use surrounding Station 21FLBROW27 is primarily high-density residential and commercial.

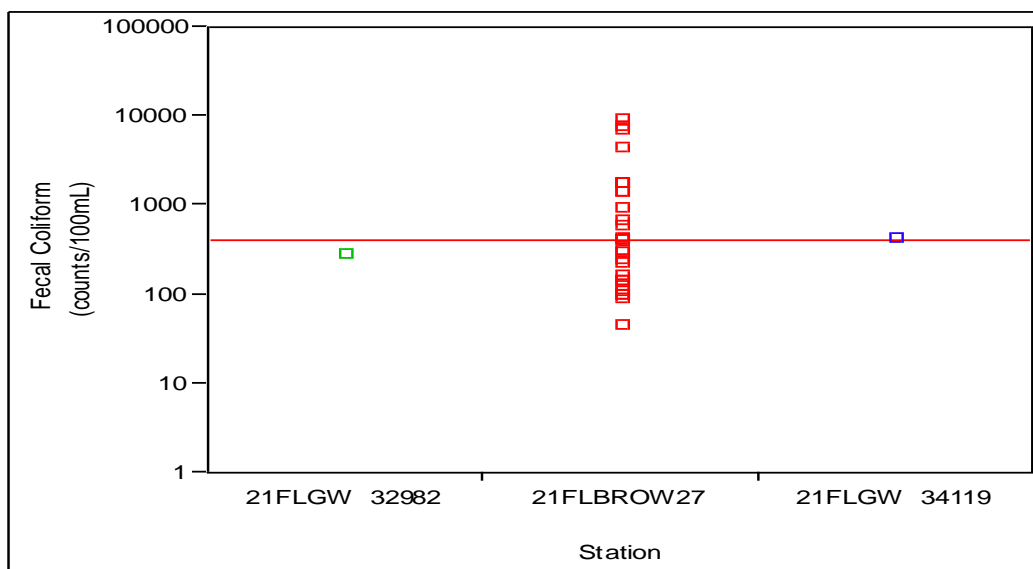


Figure 5.5s. Spatial Fecal Coliform Concentration Trends in the C-11 (East) (WBID 3281) by Station during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

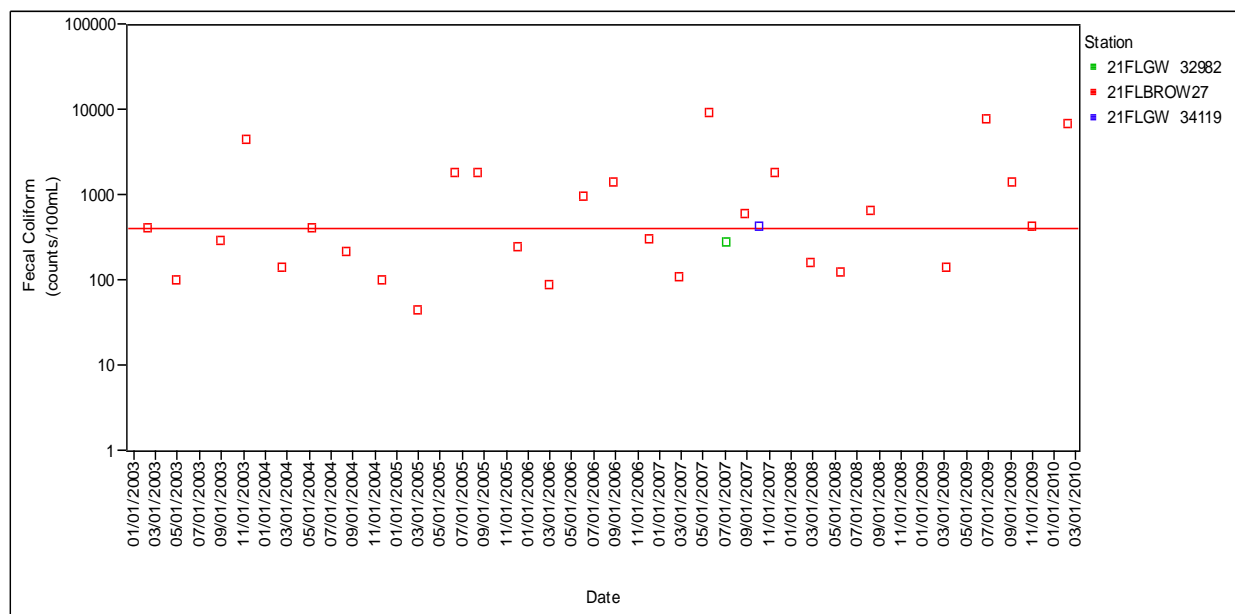


Figure 5.5t. Spatial Fecal Coliform Concentration Trends in the C-11 (East) (WBID 3281) by Date during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

Note: The red line indicates the target concentration (400 counts/100mL).

Table 5.5j. Station Summary Statistics of Fecal Coliform Data for the C-11 (East) (WBID 3281) during the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

This is a nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100 mL, Column 5 lists the maximum count/100mL, Column 6 lists the mean count, Column 7 lists the median count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

¹ Coliform counts are #/100mL.

² Exceedances represent values above 400 counts/100mL.

Station	Period of Observation	Number of Samples	Minimum ¹	Maximum ¹	Median ¹	Mean ¹	Number of Exceedances ²	% Exceedances
21FLBROW27	2003-2010	28	44	9,100	400	1,490.9	13	46.4
21FLGW 32982	2007	1	280	280	280	280	0	0
21FLGW 34119	2007	1	430	430	430	430	1	100

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal/Pompano Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

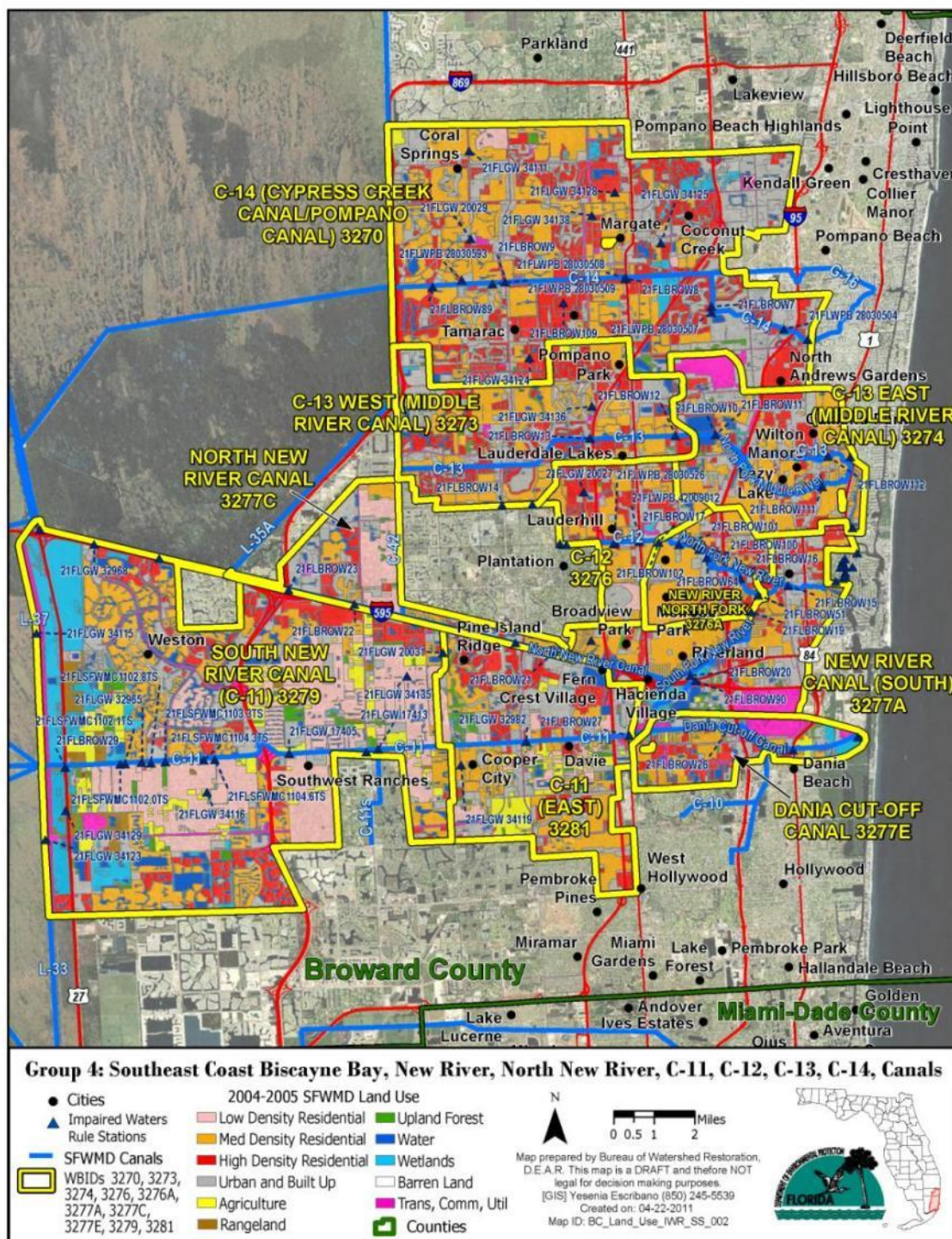


Figure 5.6. Principal Land Uses and Location of Water Quality Stations with Fecal Coliform Data in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281

5.1.2 Critical Condition

The critical condition for coliform loadings in a given watershed depends on many factors, including the presence of point sources and the land use pattern in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period followed by a rainfall runoff event. During the wet weather period, rainfall washes off coliform bacteria that have built up on the land surface under dry conditions, resulting in the wet weather exceedances. However, significant nonpoint source contributions can also appear under dry conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and fecal coliform bacteria are brought into the receiving waters through baseflow. In addition, the fecal coliform contribution of wildlife with direct access to the receiving water can be more noticeable by contributing to exceedances during dry weather. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Even though current flow data were available for the freshwater WBIDs, the impact of the hydrologic condition on fecal coliform concentration was analyzed using rainfall data. These canals are highly manipulated and regulated and may at times have no flow even when there are loadings driven by storm events entering the receiving waters; therefore, using rainfall data will be more representative of each watershed's hydrological conditions. A flow duration curve-type chart that would normally be applied to flow events was created using precipitation data from the SFWMD climate stations (**Table 5.4**). The charted rainfall duration interval was divided in the same manner as if flow were being analyzed, where extreme precipitation events represent the lower percentiles (0–5th percentile), followed by large precipitation events (5th–10th percentile), medium precipitation events (10th–40th percentile), small precipitation events (40th–60th percentile), and no recordable precipitation events (60th–100th percentile). Event precipitation intervals for each WBID were derived based on these percentile ranges and are presented in **Table 5.6**. Three-day (the day of and 2 days prior to sampling) precipitation accumulations were used in the analysis (**Tables 5.7a – 5.7j** and **Figures 5.7a – 5.7j**).

Table 5.6. Precipitation Event Ranges for Rainfall Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281

This is a seven-column table. Column 1 lists WBID, Column 2 lists rainfall periods of records, Columns 3- 6 list the event range (in in/3-Day).

WBID	Rainfall Period of Record	Precipitation Event (in/3-Day)				
		Extreme	Large	Medium	Small	None/Not Measurable
3270	1991-2011	>2.23"	1.48" - 2.23"	0.16" - 1.48"	0.01" - 0.16"	<0.01"
3273	1991-2011	>2.23"	1.48" - 2.23"	0.16" - 1.48"	0.01" - 0.16"	<0.01"
3274	1991-2011	>2.32"	1.52 - 2.32"	0.18" - 1.52"	0.02" - 0.18"	<0.02"
3276	1999-2010	>2.14"	1.45" - 2.14"	0.14" - 1.45"	0.01" - 0.14"	<0.01"
3276A	1994-2011	>2.36"	1.52" - 2.36"	0.17" - 1.52"	0.01" - 0.17"	<0.01"
3277A	1997-2010	>2.41"	1.55" - 2.41"	0.18" - 1.55"	0.01" - 0.18"	<0.01"
3277C	1999-2010	>2.14"	1.45" - 2.14"	0.14" - 1.45"	0.01" - 0.14"	<0.01"
3277E	1991-2010	>2.2"	1.4" - 2.2"	0.15" - 1.4"	0.01" - 0.15"	<0.01"
3279	1990-2010	>2.95"	2.2" - 2.95"	0.62" - 2.2"	0.25" - 0.62"	<0.25"
3281	1990-2010	>3.63"	2.55" - 3.63"	0.73" - 2.55"	0.24" - 0.73"	<0.24"

C-14 (Cypress Creek) Canal (WBID 3270)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances occurred after periods of large and extreme precipitation events (50% and 42% respectively). The lowest percentage of exceedances occurred after periods of no measurable precipitation (8%).

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events, and that there are no point source dischargers within the WBID boundary other than a permitted point source (e.g., a WWTP) which transports wastewater to the Atlantic Ocean via ocean outfalls, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7a and **Figure 5.7a** show fecal coliform data for WBID 3270 by hydrologic condition.

Table 5.7a. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-14 (Cypress Creek) Canal (WBID 3270)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.23"	18	6	33%	12	67%
Large	1.48" - 2.23"	0	0	0%	0	0%
Medium	0.16" - 1.48"	39	9	23%	30	77%
Small	0.01" - 0.16"	40	4	10%	36	90%
None/ Not Measurable	<0.01"	47	4	8.5%	43	91.5%

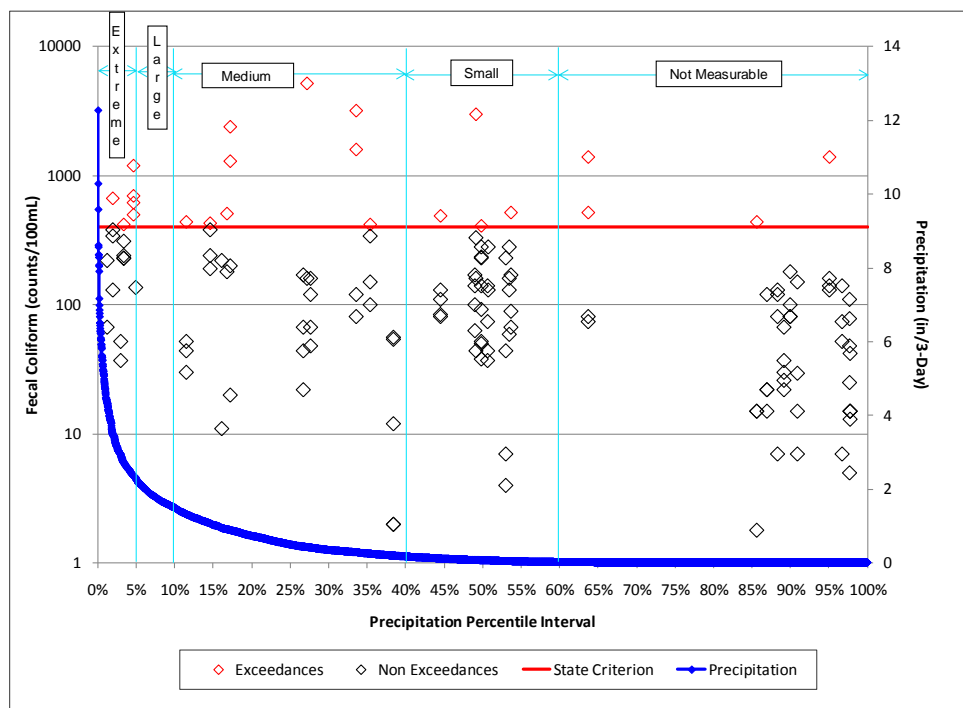


Figure 5.7a. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-14 (Cypress Creek) Canal (WBID 3270)

As fecal coliform exceedances occurred in all the precipitation intervals — extreme, large, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8a** is applicable under all rainfall conditions in the C-14 (Cypress Creek) Canal (WBID 3270).

C-13 West (Middle River) Canal (WBID 3273)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for large precipitation events. No observed exceedances in the large precipitation interval might be due to the small number of samples collected during these events (n=1). The highest percentage of exceedances occurred after periods of medium precipitation (44%). The lowest percentage of exceedances occurred after periods of no measurable precipitation (5%).

Given that exceedance rates and exceeding concentrations followed all of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7b and **Figure 5.7b** show fecal coliform data for WBID 3273 by hydrologic condition.

Table 5.7b. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 West (Middle River) Canal (WBID 3273)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.23"	3	3	100%	0	0%
Large	1.48" - 2.23"	0	0	0%	0	0%
Medium	0.16" - 1.48"	26	4	15%	22	85%
Small	0.01" - 0.16"	18	2	11%	16	89%
None/ Not Measurable	<0.01"	23	2	8.7%	21	91.3%

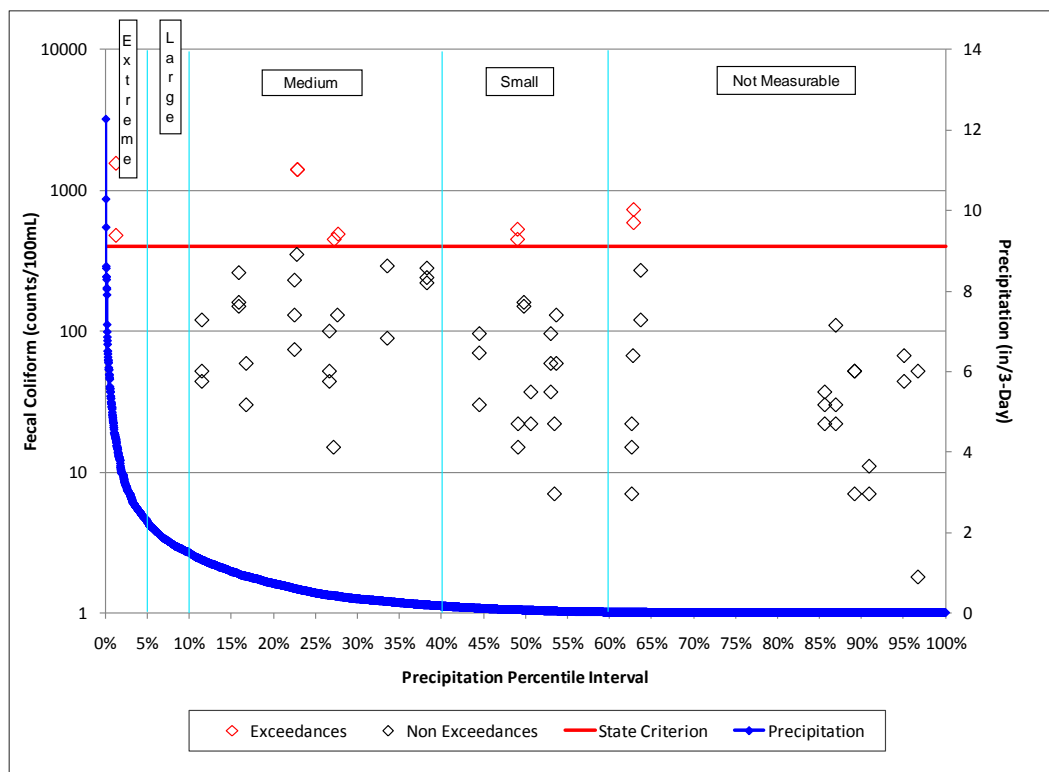


Figure 5.7b. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 West (Middle River) Canal (WBID 3273)

As fecal coliform exceedances occurred in the majority of precipitation intervals — extreme, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8b** is applicable under all rainfall conditions in the C-13 West (Middle River) Canal (WBID 3273).

C-13 East (Middle River) Canal (WBID 3274)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for extreme precipitation events. No observed exceedances in the extreme precipitation interval might be due to the small number of samples collected during these events ($n=1$). The highest percentage of exceedances occurred after periods of large precipitation (100%). In addition, more than half of samples collected during medium precipitation events (51%) had exceeding fecal coliform concentrations. The lowest percentage of exceedances occurred after periods of no measurable precipitation (17%).

Given that exceedance rates and exceeding concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after

periods of no or little rainfall, the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7c and **Figure 5.7c** show fecal coliform data for WBID 3274 by hydrologic condition.

Table 5.7c. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 East (Middle River) Canal (WBID 3274)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.32"	1	0	0%	1	100%
Large	1.52 - 2.32"	5	5	100%	0	0%
Medium	0.18" - 1.52"	54	25	46.3%	29	54%
Small	0.02" - 0.18"	40	13	32.5%	27	68%
None/ Not Measurable	<0.02"	53	7	13.2%	46	86.8%

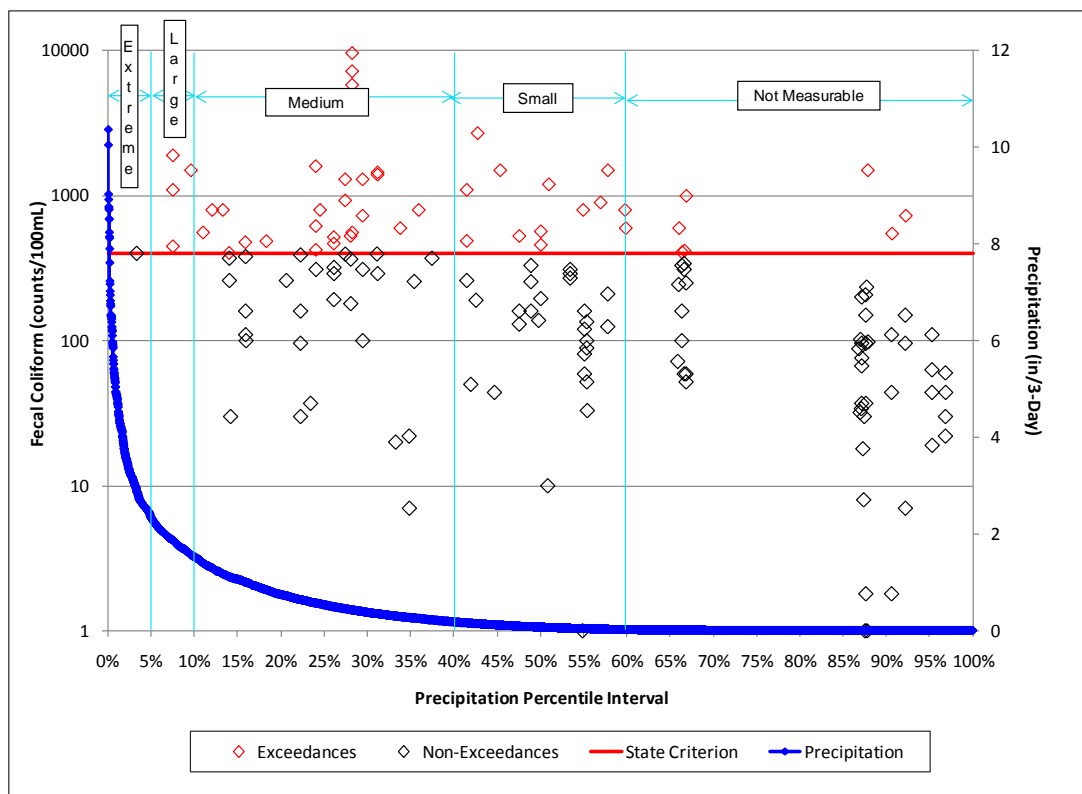


Figure 5.7c. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-13 East (Middle River) Canal (WBID 3274)

As fecal coliform exceedances occurred in the majority of precipitation intervals — large, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8c** is applicable under all rainfall conditions in the C-13 East (Middle River) Canal (WBID 3274).

C-12 Canal (WBID 3276)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for small precipitation events. The highest percentage of exceedances occurred after periods of extreme precipitation (60%). The lowest percentage of exceedances occurred after periods of large precipitation (17%).

Given that exceedance rates and exceeding concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. That the highest exceedance rate occurred after an extreme precipitation event rather than after periods of little or no rainfall indicates that nonpoint sources are probably a major contributing factor. While one of the lower percentages of

exceedances occurred after periods of no or little rainfall (18%), the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7d and Figure 5.7d show fecal coliform data for WBID 3276 by hydrologic condition.

Table 5.7d. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-12 Canal (WBID 3276)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.14"	5	3	60%	2	40%
Large	1.45" - 2.14"	6	1	17%	5	83%
Medium	0.14" - 1.45"	12	4	33.3%	8	67%
Small	0.01" - 0.14"	6	0	0.0%	6	100%
None/ Not Measurable	<0.01"	28	5	17.9%	23	82.1%

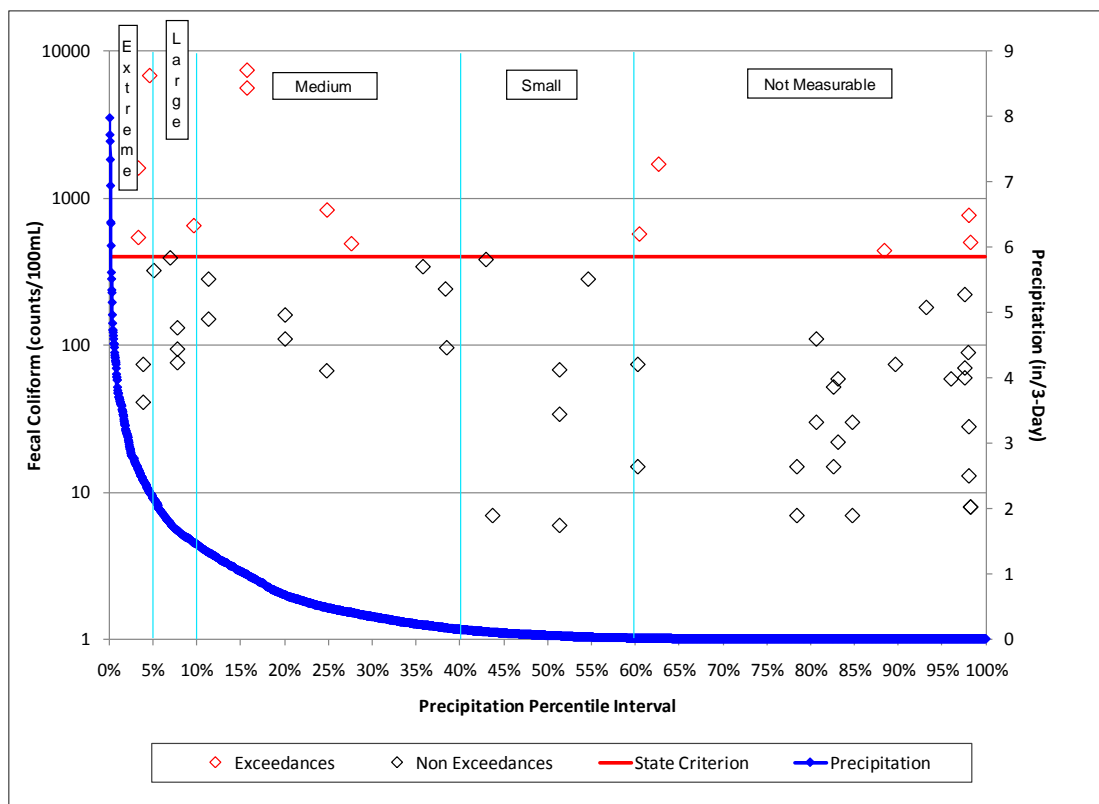


Figure 5.7d. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-12 Canal (WBID 3276)

As fecal coliform exceedances occurred in the majority of precipitation intervals — extreme, large, medium, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8d** is applicable under all rainfall conditions in the C-12 Canal (WBID 3276).

New River (North Fork) (WBID 3276A)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. Percentages of exceedances greater than 50% occurred after all sampled events. The highest percentage of exceedances occurred after periods of extreme and large precipitation (100% for both). The lowest percentage of exceedances occurred after periods of small precipitation (62%).

Given that exceedance rates and exceeding concentrations followed all of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. That the high exceedance rates occurred after all precipitation

events rather indicates that both nonpoint sources and local sources are major contributing factors to elevated fecal coliform concentrations.

Table 5.7e and Figure 5.7e show fecal coliform data for WBID 3276A by hydrologic condition.

Table 5.7e. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the New River (North Fork) (WBID 3276A)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.36"	2	2	100%	0	0%
Large	1.52" - 2.36"	2	2	100%	0	0%
Medium	0.17" - 1.52"	16	14	87.5%	2	13%
Small	0.01" - 0.17"	13	8	61.5%	5	38%
None/ Not Measurable	<0.01"	20	13	65.0%	7	35.0%

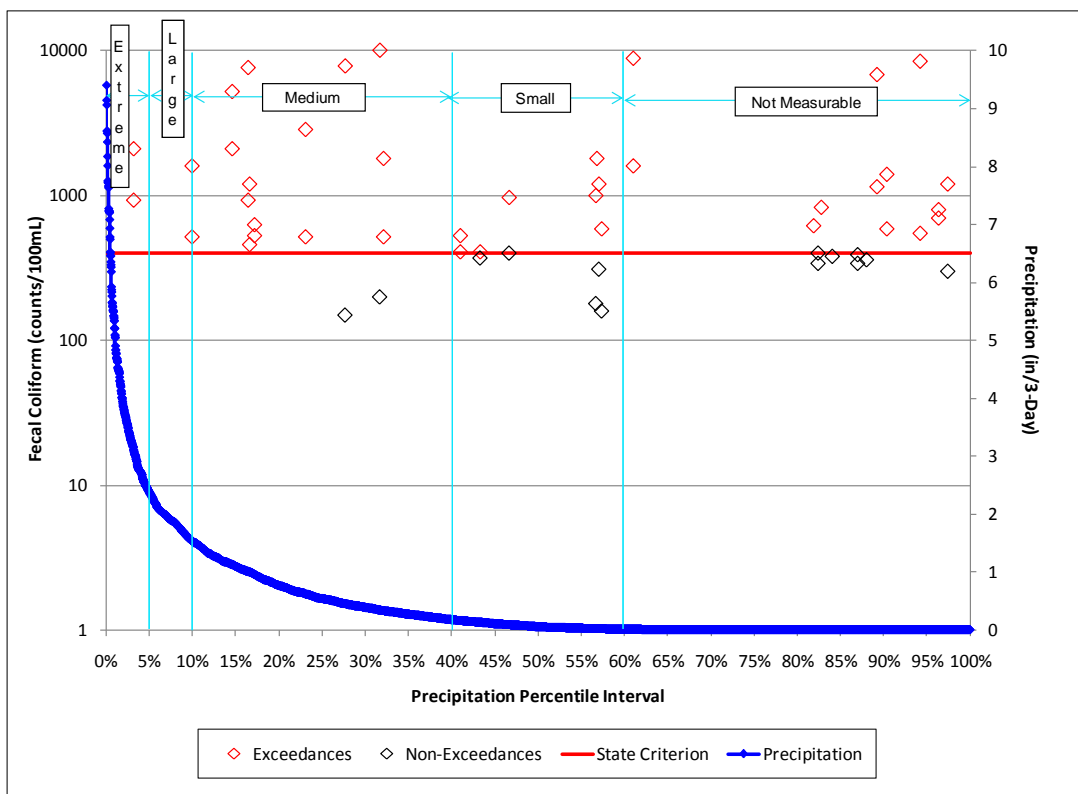


Figure 5.7e. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the New River (North Fork) (WBID 3276A)

As fecal coliform exceedances occurred in all the precipitation intervals — extreme, large, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8e** is applicable under all rainfall conditions in the New River (North Fork) (WBID 3276A).

New River Canal (South) (WBID 3277A)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances occurred after periods of extreme and large precipitation (77% and 88%, respectively). The lowest percentages of exceedances occurred after periods of small and no measurable precipitation (8% and 7%, respectively).

Given that high exceedance rates and high concentrations followed all of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID.

While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7f and Figure 5.7f show fecal coliform data for WBID 3277A by hydrologic condition.

Table 5.7f. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the New River Canal (South) (WBID 3277A)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.41"	13	10	77%	3	23%
Large	1.55" - 2.41"	8	7	88%	1	13%
Medium	0.18" - 1.55"	33	9	27.3%	24	73%
Small	0.01" - 0.18"	13	1	7.7%	12	92%
None/ Not Measurable	<0.01"	44	3	6.8%	41	93.2%

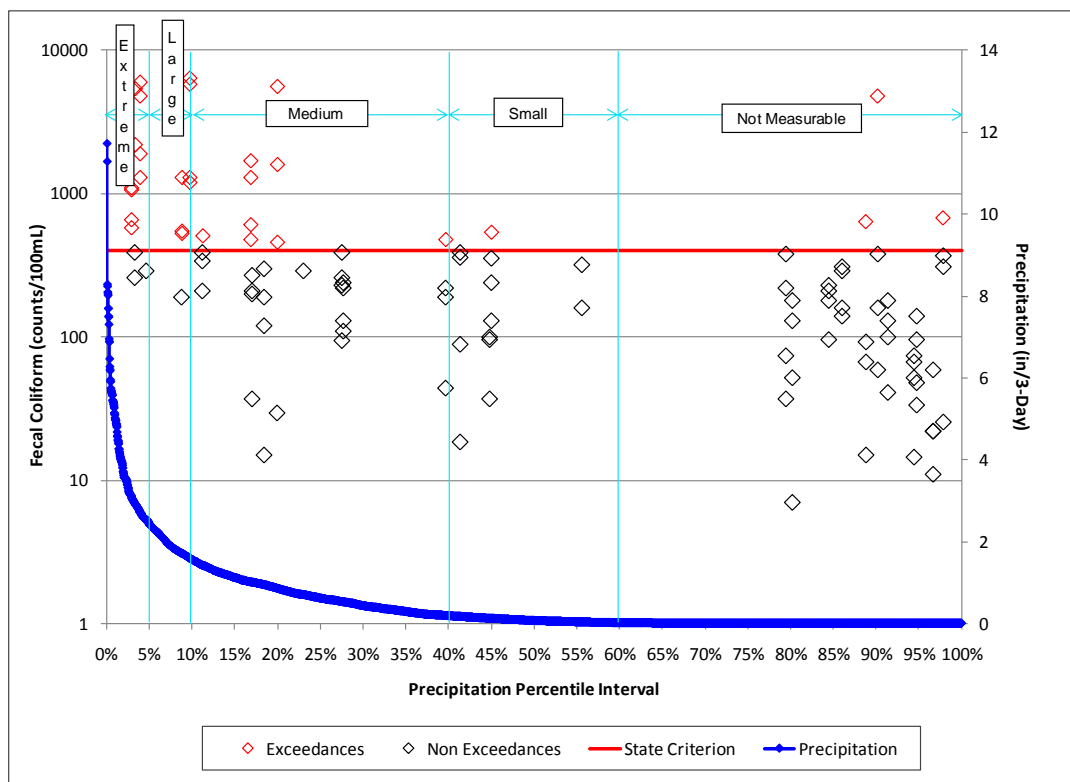


Figure 5.7f. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the South Fork New River (WBID 3277A)

As fecal coliform exceedances occurred in all the precipitation intervals — extreme, large, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8f** is applicable under all rainfall conditions in the New River Canal (South) (WBID 3277A).

North New River Canal (WBID 3277C)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances occurred after periods of large precipitation (70%). The lowest percentage of exceedances occurred after periods of no measurable precipitation (5%).

Given that high exceedance rates and high concentrations followed all of the sampled precipitation events, and that there are no point source dischargers within the WBID boundary other than permitted point sources (e.g., a WWTP), it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7g and Figure 5.7g show fecal coliform data for WBID 3277C by hydrologic condition.

Table 5.7g. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the North New River Canal (WBID 3277C)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.14"	8	2	25%	6	75%
Large	1.45" - 2.14"	7	5	71%	2	29%
Medium	0.14" - 1.45"	20	4	20.0%	16	80%
Small	0.01" - 0.14"	10	3	30.0%	7	70%
None/ Not Measurable	<0.01"	39	2	5.1%	37	94.9%

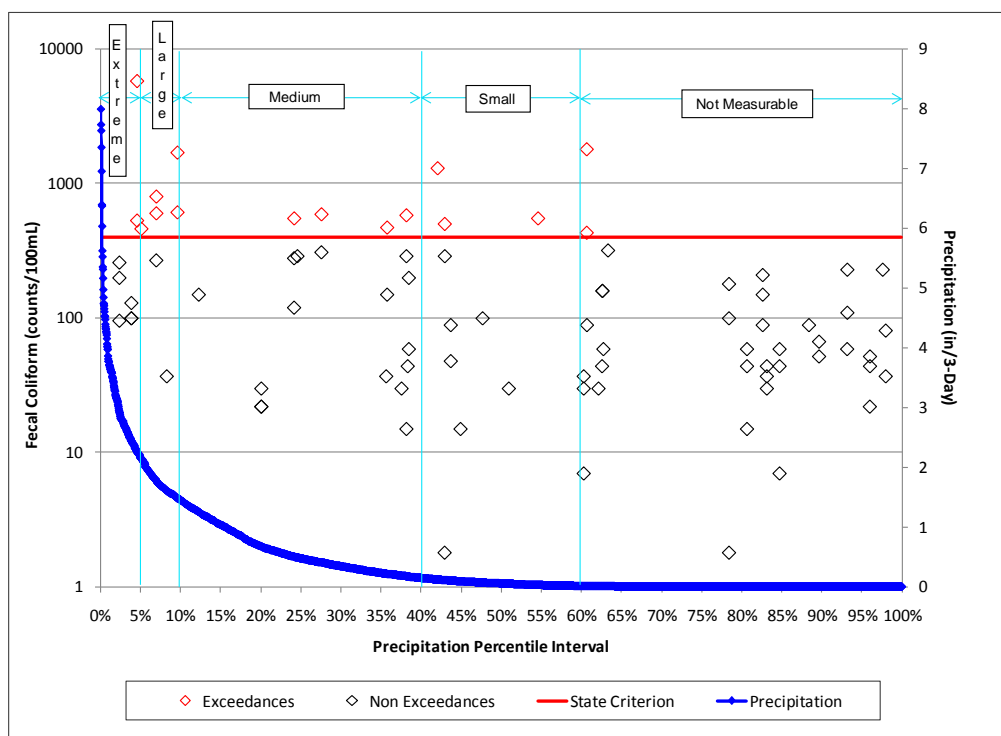


Figure 5.7g. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the North New River Canal (WBID 3277C)

As fecal coliform exceedances occurred in all the precipitation intervals — extreme, large, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8g** is applicable under all rainfall conditions in the North New River Canal (WBID 3277C).

Dania Cut-off Canal (WBID 3277E)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for small precipitation events. The highest percentage of exceedances occurred after periods of extreme and large precipitation (100% and 75%, respectively). The lowest percentage of exceedances occurred after periods of no measurable precipitation (4%).

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID.

While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant as this might be an indication that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7h and Figure 5.7h show fecal coliform data for WBID 3277E by hydrologic condition.

Table 5.7h. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the Dania Cut-off Canal (WBID 3277E)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.2"	4	4	100%	0	0%
Large	1.4" - 2.2"	4	3	75%	1	25%
Medium	0.15" - 1.4"	25	10	40.0%	15	60%
Small	0.01" - 0.15"	11	0	0.0%	11	100%
None/ Not Measurable	<0.01"	23	1	4.3%	22	95.7%

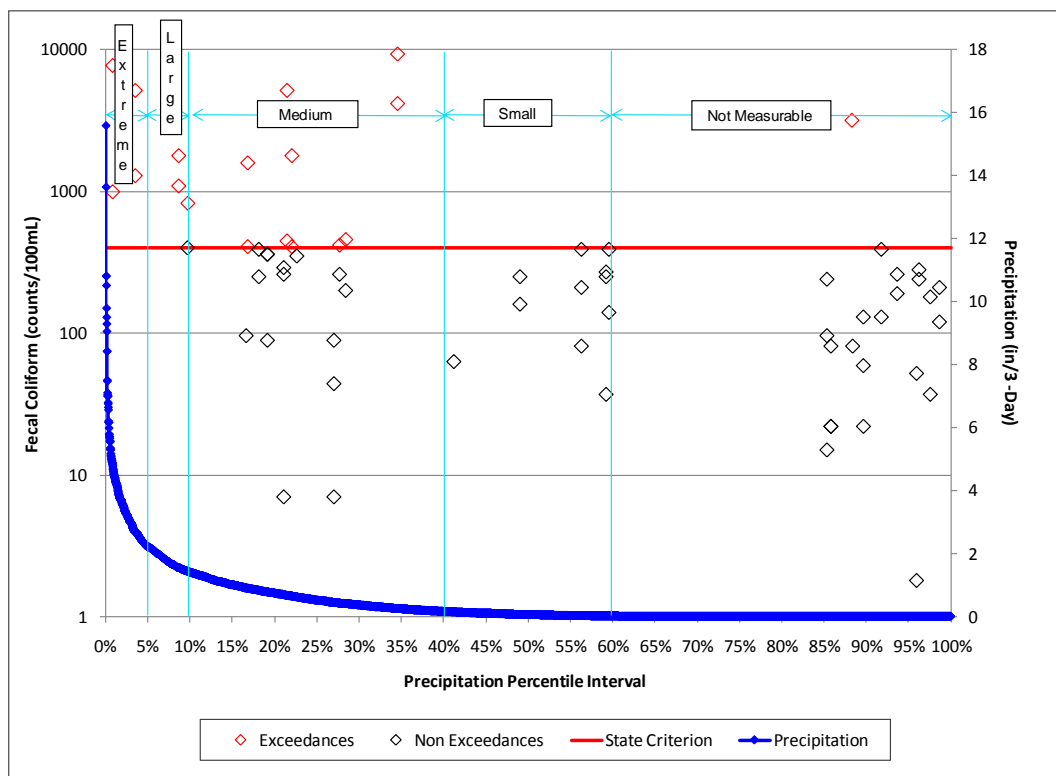


Figure 5.7h. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the Dania Cut-off Canal (WBID 3277E)

As fecal coliform exceedances occurred in the majority of the precipitation intervals — extreme, large, medium, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8h** is applicable under all rainfall conditions in the Dania Cut-off Canal (WBID 3277E).

South New River Canal (C-11) (WBID 3279)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for large precipitation events. The highest percentage of exceedances occurred after periods of extreme precipitation (50%); however, this period also had the fewest number of samples collected ($n=2$). The lowest percentage of exceedances occurred after periods of small precipitation (27%). A relatively high percentage of exceedances occurred after periods of none or not measurable precipitation (31%).

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. That high exceedance rates occurred after all precipitation events

indicates that both nonpoint sources and local sources are major contributing factors to elevated fecal coliform concentrations.

Table 5.7i and Figure 5.7i show fecal coliform data for WBID 3279 by hydrologic condition.

Table 5.7i. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the South New River Canal (C-11) (WBID 3279)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>2.95"	2	1	50%	1	50%
Large	2.2" - 2.95"	6	0	0%	6	100%
Medium	0.62" - 2.2"	15	5	33.3%	10	67%
Small	0.25" - 0.62"	15	4	26.7%	11	73%
None/ Not Measurable	<0.25"	36	11	30.6%	25	69.4%

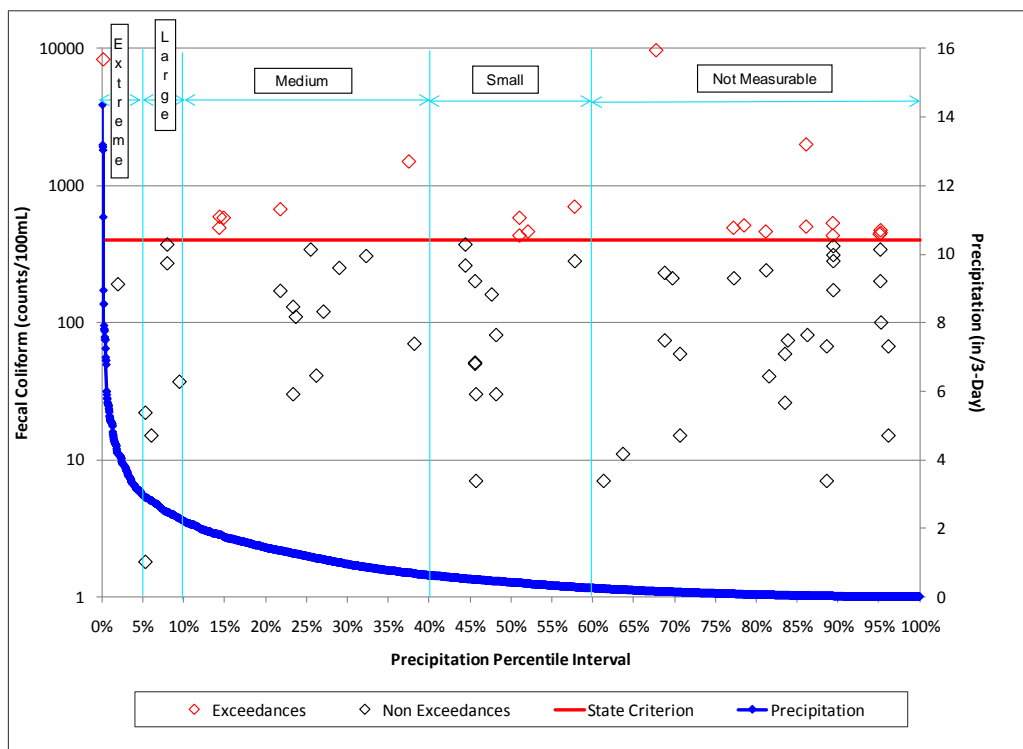


Figure 5.7i. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the South New River Canal (C-11) (WBID 3279)

As fecal coliform exceedances occurred in the majority of precipitation intervals — extreme, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8i** is applicable under all rainfall conditions in the South New River Canal (C-11) (WBID 3279).

C-11 (East) (WBID 3281)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for extreme precipitation events. No observed exceedances in the extreme precipitation interval might be due to the small number of samples collected during these events (n=1). The highest percentages of exceedances occurred after periods of large and small precipitation (100% and 60%, respectively). The lowest percentage of exceedances occurred after periods of no measurable precipitation (27%).

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events, and that there are no point source dischargers within the WBID boundary other than a permitted point source (e.g., a WWTP) which transports wastewater to the Atlantic Ocean via ocean outfalls, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. In addition, that high exceedance rates occurred after all precipitation events indicates that both nonpoint sources and local sources are major contributing factors to elevated fecal coliform concentrations.

No fecal coliform exceedances were reported for the permitted point source in the WBID, the Town of Davie WWTP (permit FL0040541) during the Cycle 2 verified period (2003-10) in the Permit Compliance System (PCS) Data Monitoring Reports. **Table 5.7j** and **Figure 5.7j** show fecal coliform data for WBID 3271 by hydrologic condition.

Table 5.7j. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-11 (East) (WBID 3281)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Column 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>3.63"	1	0	0%	1	100%
Large	2.55" - 3.63"	3	3	100%	0	0%
Medium	0.73" - 2.55"	10	5	50%	5	50%
Small	0.24" - 0.73"	5	3	60%	2	40%
None/ Not Measurable	<0.24"	11	3	27%	8	73%

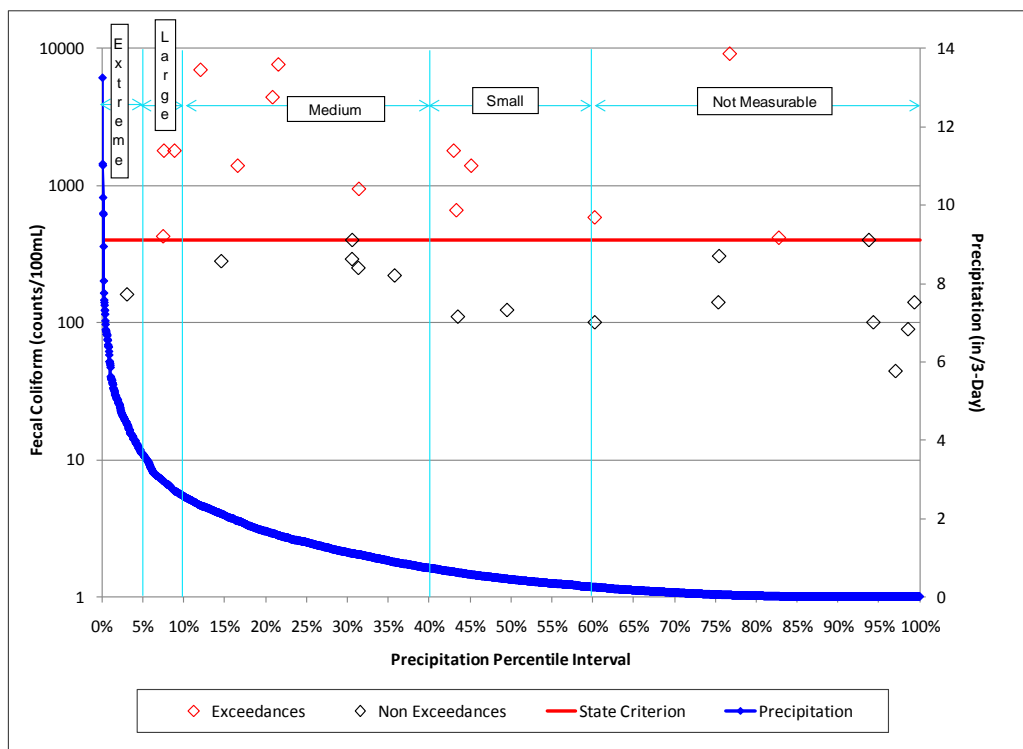


Figure 5.7j. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010) by Hydrologic Condition for the C-11 East (South New River) Canal (WBID 3281)

As fecal coliform exceedances occurred in the majority of precipitation intervals — large, medium, small, and not-measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8j** is applicable under all rainfall conditions in the C-11 (East) (WBID 3281).

5.1.3 TMDL Development Process

A simple reduction calculation was performed to determine the reduction in fecal coliform concentration necessary to achieve the concentration target (400 counts/100mL). The percent reduction needed to reduce the pollutant load was calculated by comparing the existing concentrations and target concentration using **Formula 1**:

$$\text{Needed \% Reduction} = \frac{\text{Existing 90}^{\text{th}} \text{ Percentile Concentration} - \text{Allowable Concentration}}{\text{Existing 90}^{\text{th}} \text{ Percentile Concentration}} \times 100 \quad \text{Formula 1}$$

Using the Hazen method for estimating percentiles, as described in Hunter (2002), the existing condition concentration was defined as the 90th percentile of all the fecal coliform data collected during the Cycle 2 verified period (January 1, 2003, to June 30, 2010). This will result in a target condition that is consistent with the state bacteriological water quality assessment threshold for Class III waters.

In applying this method, all of the available data are ranked (ordered) from the lowest to the highest (**Tables 5.8a – 5.8j**), and **Formula 2** is used to determine the percentile value of each data point.

$$\text{Percentile} = \frac{\text{Rank} - 0.5}{\text{Total Number of Samples Collected}} \quad \text{Formula 2}$$

If none of the ranked values is shown to be the 90th percentile value, then the 90th percentile number (used to represent the existing condition concentration) is calculated by interpolating between the two data points adjacent (above and below) to the desired 90th percentile rank using **Formula 3** as described below; data for WBID 3273 are used as an example.

$$90^{\text{th}} \text{ Percentile Concentration} = C_{\text{lower}} + (P_{90^{\text{th}}} * R) \quad \text{Formula 3}$$

Where:

- C_{lower} is the fecal coliform concentration corresponding to the percentile lower than the 90th percentile (e.g. WBID 3273 in this case, 490 counts/100mL).
- $P_{90^{\text{th}}}$ is the percentile difference between the 90th percentile and the percentile number immediately lower than the 90th percentile (in this case, 89%), or 90% – 89% = 1%.
- R is a ratio defined as $R = (\text{fecal coliform concentration}_{\text{upper}} - \text{fecal coliform concentration}_{\text{lower}}) / (\text{percentile}_{\text{upper}} - \text{percentile}_{\text{lower}})$.

To calculate R , the percentile values below and above the 90th percentile were identified, in this case, 89 and 91 percent, respectively (**Table 5.8b**). Next, the fecal coliform concentrations

corresponding to the lower and upper percentile values were identified (490 and 530 counts/100mL, respectively) (**Table 5.8b**). The fecal coliform concentration difference between the lower and higher percentiles was then calculated and divided by the unit percentile. The unit percentile difference is the difference between the lower and upper percentiles (e.g., 91% – 89% = 2 percentile unit difference). R was then calculated as $R = (530 - 490) / (91\% - 89\%) = 20$.

The C_{lower} , P_{90th} , and R , were substituted into **Formula 3** to calculate the 90th percentile fecal coliform concentration (i.e., 90th percentile concentration = $490 + (1 \times 20) = 510$ counts/100mL).

Using **Formula 1**, the percent reductions for the period of observation (January 1, 2003, to June 30, 2010) were calculated for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 and are presented in **Tables 5.8a – 5.8j**. (e.g. for WBID 3273, % reduction needed = $[(510 - 400) / 510] \times 100 = 21.6\%$).

Tables 5.8a – 5.8j present the individual fecal coliform data, the ranks, the percentiles for each individual data, the existing 90th percentile concentration, the allowable concentration (400 counts/100mL), and the percent reduction needed to meet the applicable water quality criterion for fecal coliform.

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

Table 5.8a. Calculation of Fecal Coliform Reductions for the C-14 (Cypress Creek) Canal (WBID 3270) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW109	4/23/2003	1.8	1	0%
21FLWPB 28030509	3/30/2009	2	2	1%
21FLWPB 28030593	3/30/2009	2	3	2%
21FLBROW89	2/5/2003	4	4	2%
21FLWPB 28030509	11/3/2009	5	5	3%
21FLBROW109	2/5/2003	7	6	4%
21FLBROW7	11/18/2004	7	7	5%
21FLBROW7	2/22/2006	7	8	5%
21FLBROW89	3/2/2009	7	9	6%
21FLBROW89	2/20/2008	11	10	7%
21FLWPB 28030507	3/30/2009	12	11	7%
21FLWPB 28030593	11/24/2009	13	12	8%
21FLBROW109	2/12/2004	15	13	9%
21FLBROW7	4/23/2003	15	14	9%
21FLBROW89	4/23/2003	15	15	10%
21FLBROW89	2/22/2006	15	16	11%
21FLWPB 28030504	11/24/2009	15	17	11%
21FLWPB 28030507	11/24/2009	15	18	12%
21FLWPB 28030509	11/24/2009	15	19	13%
21FLGW 34124	9/18/2007	20	20	14%
21FLBROW7	2/12/2004	22	21	14%
21FLBROW89	2/12/2004	22	22	15%
21FLBROW89	5/6/2004	22	23	16%
21FLBROW89	2/23/2005	22	24	16%
21FLWPB 28030593	11/3/2009	25	25	17%
21FLBROW109	2/23/2005	26	26	18%
21FLBROW8	2/22/2006	29.5	27	18%
21FLBROW7	2/23/2005	30	28	19%
21FLBROW8	11/30/2005	30	29	20%
21FLBROW8	2/23/2005	37	30	20%
21FLBROW89	5/31/2006	37	31	21%
21FLBROW89	2/19/2007	37	32	22%
21FLWPB 28030509	8/31/2009	38	33	23%
21FLWPB 28030508	11/24/2009	42	34	23%
21FLBROW109	5/6/2004	44	35	24%
21FLBROW7	2/5/2003	44	36	25%
21FLBROW7	2/19/2007	44	37	25%
21FLBROW89	11/30/2005	44	38	26%
21FLBROW89	2/1/2010	44	39	27%
21FLBROW7	6/22/2009	48	40	27%
21FLWPB 28030504	11/3/2009	48	41	28%
21FLWPB 28030593	8/31/2009	50	42	29%
21FLBROW7	11/30/2005	52	43	30%
21FLBROW7	3/2/2009	52	44	30%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW8	5/31/2006	52	45	31%
21FLWPB 28030504	8/31/2009	52	46	32%
21FLWPB 28030508	3/30/2009	54	47	32%
21FLWPB 28030504	3/30/2009	56	48	33%
21FLBROW7	11/29/2006	59	49	34%
21FLBROW89	5/14/2007	63	50	34%
21FLBROW6	2/23/2005	67	51	35%
21FLBROW6	6/1/2006	67	52	36%
21FLBROW7	5/6/2004	67	53	36%
21FLBROW89	6/22/2009	67	54	37%
21FLBROW89	10/26/2009	67	55	38%
21FLBROW6	2/19/2007	74	56	39%
21FLBROW8	3/2/2009	74	57	39%
21FLBROW89	8/4/2008	74	58	40%
21FLWPB 28030508	11/3/2009	78	59	41%
21FLBROW6	11/18/2004	81	60	41%
21FLBROW6	8/11/2005	81	61	42%
21FLBROW7	8/23/2006	81	62	43%
21FLBROW7	8/4/2008	81	63	43%
21FLBROW8	8/11/2005	81	64	44%
21FLBROW89	11/14/2007	81	65	45%
21FLGW 34138	10/31/2007	84	66	45%
21FLBROW7	10/26/2009	89	67	46%
21FLWPB 28030508	8/31/2009	92	68	47%
21FLBROW6	8/12/2004	100	69	48%
21FLBROW7	8/11/2005	100	70	48%
21FLBROW7	5/14/2007	100	71	49%
21FLBROW7	11/14/2007	110	72	50%
21FLWPB 28030507	11/3/2009	110	73	50%
21FLBROW109	11/18/2004	120	74	51%
21FLBROW6	2/12/2004	120	75	52%
21FLBROW8	6/22/2009	120	76	52%
21FLBROW89	8/23/2006	120	77	53%
21FLBROW109	11/5/2003	130	78	54%
21FLBROW6	11/14/2007	130	79	55%
21FLBROW7	5/12/2008	130	80	55%
21FLBROW8	11/29/2006	130	81	56%
21FLBROW89	11/18/2004	130	82	57%
21FLBROW89	8/22/2007	130	83	57%
21FLGW 20029	8/12/2003	136	84	58%
21FLBROW6	5/12/2008	140	85	59%
21FLBROW6	3/2/2009	140	86	59%
21FLBROW8	2/19/2007	140	87	60%
21FLBROW8	5/14/2007	140	88	61%
21FLBROW8	8/31/2009	140	89	61%
21FLBROW6	2/22/2006	150	90	62%
21FLBROW7	8/12/2004	150	91	63%
21FLBROW6	6/22/2009	160	92	64%
21FLBROW7	8/20/2007	160	93	64%
21FLBROW7	2/1/2010	160	94	65%
21FLBROW8	5/12/2008	160	95	66%
21FLBROW89	11/29/2006	160	96	66%
21FLBROW6	5/6/2004	170	97	67%
21FLBROW6	5/14/2007	170	98	68%
21FLBROW8	10/26/2009	170	99	68%
21FLBROW7	2/18/2008	180	100	69%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW89	8/11/2005	180	101	70%
21FLBROW109	8/28/2003	190	102	70%
21FLGW 34128	9/18/2007	200	103	71%
21FLBROW7	6/1/2006	220	104	72%
21FLBROW8	2/20/2008	220	105	73%
21FLWPB 28030593	6/25/2009	228	106	73%
21FLBROW6	2/5/2003	230	107	74%
21FLBROW89	8/31/2009	230	108	75%
21FLWPB 28030507	6/25/2009	230	109	75%
21FLWPB 28030507	8/31/2009	234	110	76%
21FLBROW7	8/28/2003	240	111	77%
21FLWPB 28030508	6/25/2009	240	112	77%
21FLBROW6	11/29/2006	280	113	78%
21FLBROW6	8/31/2009	280	114	79%
21FLBROW8	8/22/2007	280	115	80%
21FLWPB 28030509	6/25/2009	310	116	80%
21FLBROW6	2/1/2010	330	117	81%
21FLBROW7	11/5/2003	340	118	82%
21FLBROW89	8/12/2004	340	119	82%
21FLBROW6	8/28/2003	380	120	83%
21FLBROW6	11/5/2003	380	121	84%
21FLBROW7	8/31/2009	410	122	84%
21FLBROW109	8/12/2004	420	123	85%
21FLWPB 28030504	6/25/2009	420	124	86%
21FLBROW89	8/28/2003	430	125	86%
21FLBROW6	4/23/2003	440	126	87%
21FLBROW6	11/30/2005	440	127	88%
21FLBROW8	11/14/2007	490	128	89%
21FLBROW8	6/2/2005	500	129	89%
21FLBROW6	2/18/2008	510	130	90%
21FLBROW6	8/4/2008	520	131	91%
21FLBROW6	10/26/2009	520	132	91%
21FLBROW7	6/2/2005	620	133	92%
21FLBROW89	11/5/2003	670	134	93%
21FLBROW6	6/2/2005	700	135	93%
21FLBROW89	6/2/2005	1200	136	94%
21FLGW 34125	9/18/2007	1300	137	95%
21FLBROW8	8/4/2008	1400	138	95%
21FLBROW89	5/12/2008	1400	139	96%
21FLBROW8	8/23/2006	1600	140	97%
21FLGW 34111	9/18/2007	2400	141	98%
21FLBROW8	2/1/2010	3000	142	98%
21FLBROW6	8/23/2006	3200	143	99%
21FLBROW6	8/20/2007	5200	144	100%
-	-	-	Existing condition concentration-90th percentile (counts/100mL)	510
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	22

Table 5.8b. Calculation of Fecal Coliform Reductions for the C-13 West (Middle River) Canal (WBID 3273) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW12	3/2/2009	1.8	1	1%
21FLBROW12	11/17/2004	7	2	2%
21FLBROW12	2/24/2005	7	3	4%
21FLBROW14	2/22/2006	7	4	5%
21FLBROW14	11/29/2006	7	5	6%
21FLBROW12	2/22/2006	11	6	8%
21FLBROW14	11/17/2004	15	7	9%
21FLBROW12	8/20/2007	15	8	11%
21FLBROW12	2/1/2010	15	9	12%
21FLBROW12	4/23/2003	22	10	14%
21FLBROW12	2/11/2004	22	11	15%
21FLBROW13	11/17/2004	22	12	16%
21FLBROW12	11/29/2006	22	13	18%
21FLBROW12	2/19/2007	22	14	19%
21FLBROW14	2/1/2010	22	15	21%
21FLBROW14	4/23/2003	30	16	22%
21FLBROW14	2/11/2004	30	17	24%
21FLBROW12	11/14/2007	30	18	25%
21FLBROW12	2/18/2008	30	19	26%
21FLBROW13	4/23/2003	37	20	28%
21FLBROW14	2/6/2003	37	21	29%
21FLBROW14	2/19/2007	37	22	31%
21FLBROW12	5/5/2004	44	23	32%
21FLBROW14	12/1/2005	44	24	34%
21FLBROW12	5/12/2008	44	25	35%
21FLBROW14	5/5/2004	52	26	36%
21FLBROW13	2/24/2005	52	27	38%
21FLBROW13	12/1/2005	52	28	39%
21FLBROW14	2/24/2005	52	29	41%
21FLBROW14	3/2/2009	52	30	42%
21FLBROW12	2/6/2003	59	31	44%
21FLBROW14	2/18/2008	59	32	45%
21FLBROW14	10/26/2009	59	33	46%
21FLBROW12	8/10/2005	67	34	48%
21FLBROW14	5/12/2008	67	35	49%
21FLGW 34136	10/31/2007	70	36	51%
21FLBROW14	6/8/2005	74	37	52%
21FLBROW12	8/23/2006	89	38	54%
21FLBROW13	2/6/2003	96	39	55%
21FLBROW14	11/14/2007	96	40	56%
21FLBROW13	5/5/2004	100	41	58%
21FLBROW13	2/11/2004	110	42	59%
21FLBROW12	12/1/2005	120	43	61%
21FLBROW14	8/4/2008	120	44	62%
21FLBROW13	6/8/2005	130	45	64%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW12	6/22/2009	130	46	65%
21FLBROW12	10/26/2009	130	47	66%
21FLBROW14	8/13/2003	150	48	68%
21FLBROW14	8/31/2009	150	49	69%
21FLBROW12	8/13/2003	160	50	71%
21FLBROW12	8/31/2009	160	51	72%
21FLBROW12	8/11/2004	220	52	74%
21FLBROW12	6/8/2005	230	53	75%
21FLBROW13	8/11/2004	240	54	76%
21FLBROW13	8/13/2003	260	55	78%
21FLBROW12	8/4/2008	270	56	79%
21FLBROW14	8/11/2004	280	57	81%
21FLBROW14	8/23/2006	290	58	82%
21FLBROW12	11/6/2003	350	59	84%
21FLBROW14	5/14/2007	450	60	85%
21FLBROW14	8/20/2007	450	61	86%
21FLBROW14	6/1/2006	480	62	88%
21FLBROW14	6/22/2009	490	63	89%
21FLBROW12	5/14/2007	530	64	91%
21FLBROW13	8/10/2005	590	65	92%
21FLBROW14	8/10/2005	730	66	94%
21FLBROW13	11/6/2003	1400	67	95%
21FLBROW14	11/6/2003	1400	68	96%
21FLBROW12	6/1/2006	1550	69	98%
21FLGW 34121	9/25/2007	2600	70	99%
-	-	-	Existing condition concentration–90th percentile (counts/100mL)	510
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	22

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

Table 5.8c. Calculation of Fecal Coliform Reductions for the C-13 East (Middle River) Canal (WBID 3274) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH BROWARD31	3/31/2003	1	1	0%
21FLDOH BROWARD31	4/14/2003	1	2	1%
21FLDOH BROWARD31	5/19/2003	1	3	2%
21FLBROW10	2/24/2005	1.8	4	2%
21FLBROW10	4/23/2003	1.8	5	3%
21FLBROW10	2/23/2006	7	6	4%
21FLBROW10	8/6/2008	7	7	4%
21FLDOH BROWARD31	3/10/2003	8	8	5%
21FLDOH BROWARD31	8/25/2003	10	9	6%
21FLDOH BROWARD31	3/3/2003	18	10	6%
21FLBROW10	5/14/2008	19	11	7%
21FLDOH BROWARD31	6/23/2003	20	12	8%
21FLBROW112	3/2/2009	22	13	8%
21FLBROW10	8/22/2007	22	14	9%
21FLBROW111	3/2/2009	30	15	9%
21FLDOH BROWARD31	4/7/2003	30	16	10%
21FLBROW10	5/5/2004	30	17	11%
21FLBROW10	8/24/2006	30	18	11%
21FLDOH BROWARD31	1/21/2003	32	19	12%
21FLBROW10	2/21/2007	33	20	13%
21FLDOH BROWARD31	2/3/2003	34	21	13%
21FLBROW10	2/6/2003	37	22	14%
21FLBROW10	2/20/2008	37	23	15%
21FLBROW11	4/23/2003	37	24	15%
21FLBROW112	2/24/2005	44	25	16%
21FLBROW10	3/4/2009	44	26	17%
21FLBROW112	5/12/2008	44	27	17%
21FLBROW10	10/28/2009	44	28	18%
21FLDOH BROWARD31	2/24/2003	50	29	19%
21FLBROW10	8/10/2005	52	30	19%
21FLBROW10	11/30/2006	52	31	20%
21FLBROW10	8/11/2004	59	32	21%
21FLBROW11	8/10/2005	59	33	21%
21FLBROW111	11/17/2004	59	34	22%
21FLBROW11	3/2/2009	60	35	23%
21FLBROW111	5/12/2008	63	36	23%
21FLBROW112	2/6/2003	67	37	24%
21FLDOH BROWARD31	5/5/2003	72	38	25%
21FLDOH BROWARD31	2/10/2003	76	39	25%
21FLBROW10	11/17/2004	81	40	26%
21FLDOH BROWARD31	1/6/2003	88	41	26%
21FLBROW111	11/29/2006	89	42	27%
21FLBROW111	2/6/2003	96	43	28%
21FLBROW112	2/22/2006	96	44	28%
21FLBROW112	4/23/2003	96	45	29%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW112	5/5/2004	96	46	30%
21FLDOH BROWARD31	7/14/2003	98	47	30%
21FLBROW10	2/11/2004	100	48	31%
21FLBROW10	2/3/2010	100	49	32%
21FLBROW11	6/8/2005	100	50	32%
21FLBROW112	11/29/2006	100	51	33%
21FLDOH BROWARD31	1/27/2003	102	52	34%
21FLBROW11	2/24/2005	110	53	34%
21FLBROW11	5/12/2008	110	54	35%
21FLBROW10	12/1/2005	110	55	36%
21FLBROW112	11/17/2004	120	56	36%
21FLBROW11	2/1/2010	125	57	37%
21FLBROW112	8/20/2007	130	58	38%
21FLBROW11	11/29/2006	135	59	38%
21FLDOH BROWARD31	6/16/2003	138	60	39%
21FLBROW111	2/22/2006	150	61	40%
21FLBROW111	4/23/2003	150	62	40%
21FLBROW11	2/11/2004	160	63	41%
21FLBROW111	2/19/2007	160	64	42%
21FLBROW11	5/5/2004	160	65	42%
21FLBROW111	8/20/2007	160	66	43%
21FLBROW11	11/17/2004	160	67	43%
21FLBROW112	12/1/2005	160	68	44%
21FLBROW112	8/4/2008	180	69	45%
21FLDOH BROWARD31	2/17/2003	190	70	45%
21FLDOH BROWARD31	4/30/2003	192	71	46%
21FLBROW11	11/14/2007	195	72	47%
21FLBROW11	2/6/2003	200	73	47%
21FLDOH BROWARD31	4/21/2003	207	74	48%
21FLBROW112	2/1/2010	210	75	49%
21FLDOH BROWARD31	5/12/2003	234	76	49%
21FLDOH BROWARD31	7/21/2003	244	77	50%
21FLBROW111	8/10/2005	250	78	51%
21FLBROW11	2/19/2007	255	79	51%
21FLDOH BROWARD31	8/4/2003	256	80	52%
21FLBROW11	6/22/2009	260	81	53%
21FLBROW112	8/31/2009	260	82	53%
21FLBROW10	9/2/2009	260	83	54%
21FLBROW112	10/26/2009	270	84	55%
21FLBROW111	5/14/2007	290	85	55%
21FLBROW10	8/13/2003	290	86	56%
21FLBROW111	10/26/2009	290	87	57%
21FLBROW112	2/18/2008	310	88	57%
21FLBROW10	6/8/2005	310	89	58%
21FLBROW112	8/11/2004	310	90	58%
21FLBROW11	10/26/2009	310	91	59%
21FLBROW112	8/13/2003	320	92	60%
21FLBROW111	2/11/2004	330	93	60%
21FLBROW112	2/19/2007	330	94	61%
21FLBROW11	8/11/2004	340	95	62%
21FLBROW11	8/4/2008	365	96	62%
21FLDOH BROWARD31	6/9/2003	370	97	63%
21FLBROW111	8/31/2009	370	98	64%
21FLBROW11	12/1/2005	380	99	64%
21FLBROW111	5/5/2004	390	100	65%
21FLBROW11	8/23/2006	395	101	66%

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

21FLDOH BROWARD31	7/7/2003	396	102	66%
21FLBROW10	6/24/2009	400	103	67%
21FLBROW11	8/31/2009	405	104	68%
21FLBROW112	2/11/2004	410	105	68%
21FLBROW111	8/11/2004	420	106	69%
21FLBROW11	2/18/2008	425	107	70%
21FLBROW10	6/1/2006	450	108	70%
21FLBROW112	11/14/2007	460	109	71%
21FLBROW11	8/13/2003	470	110	72%
21FLBROW111	12/1/2005	480	111	72%
21FLDOH BROWARD31	3/17/2003	488	112	73%
21FLBROW111	6/22/2009	490	113	74%
21FLBROW111	8/13/2003	520	114	74%
21FLBROW11	8/20/2007	530	115	75%
21FLBROW111	8/4/2008	530	116	75%
21FLBROW111	2/24/2005	550	117	76%
21FLDOH BROWARD31	5/26/2003	560	118	77%
21FLBROW11	11/6/2003	560	119	77%
21FLBROW111	11/14/2007	570	120	78%
21FLDOH BROWARD31	1/14/2003	600	121	79%
21FLDOH BROWARD31	9/15/2003	600	122	79%
21FLDOH BROWARD31	9/22/2003	600	123	80%
21FLBROW111	2/18/2008	620	124	81%
21FLBROW11	2/22/2006	730	125	81%
21FLBROW111	6/8/2005	730	126	82%
21FLDOH BROWARD31	3/24/2003	800	127	83%
21FLDOH BROWARD31	7/28/2003	800	128	83%
21FLDOH BROWARD31	8/11/2003	800	129	84%
21FLDOH BROWARD31	8/18/2003	800	130	85%
21FLDOH BROWARD31	9/1/2003	800	131	85%
21FLDOH BROWARD31	9/8/2003	800	132	86%
21FLDOH BROWARD31	7/30/2003	900	133	87%
21FLBROW112	8/23/2006	930	134	87%
21FLBROW112	8/10/2005	1000	135	88%
21FLBROW111	6/1/2006	1100	136	89%
21FLBROW112	6/22/2009	1100	137	89%
21FLBROW10	11/15/2007	1200	138	90%
21FLBROW112	6/8/2005	1300	139	91%
21FLBROW111	8/23/2006	1300	140	91%
21FLBROW112	5/14/2007	1400	141	92%
21FLBROW11	5/14/2007	1450	142	92%
21FLBROW111	2/1/2010	1500	143	93%
21FLDOH BROWARD31	4/28/2003	1500	144	94%
21FLDOH BROWARD31	6/2/2003	1500	145	94%
21FLDOH BROWARD31	6/30/2003	1500	146	95%
21FLBROW10	5/16/2007	1600	147	96%
21FLBROW112	6/1/2006	1900	148	96%
21FLGW 33083	7/17/2007	2700	149	97%
21FLBROW10	11/6/2003	5800	150	98%
21FLBROW112	11/6/2003	7200	151	98%
21FLBROW11	6/1/2006	8800	152	99%
21FLBROW111	11/6/2003	9600	153	100%
-	-	-	Existing condition concentration-90th percentile (counts/100mL)	1,200

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	67

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

Table 5.8d. Calculation of Fecal Coliform Reductions for the C-12 Canal (WBID 3276) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLWPB 28030526	3/30/2009	6	1	1%
21FLBROW17	2/24/2005	7	2	3%
21FLBROW17	2/23/2006	7	3	4%
21FLBROW18	4/24/2003	7	4	6%
21FLWPB 28030526	11/24/2009	8	5	8%
21FLWPB 42009012	11/24/2009	8	6	10%
21FLWPB 42009012	11/3/2009	13	7	11%
21FLBROW17	2/5/2003	15	8	13%
21FLBROW17	4/24/2003	15	9	15%
21FLBROW18	8/11/2004	15	10	17%
21FLBROW18	11/17/2004	22	11	18%
21FLWPB 28030526	11/3/2009	28	12	20%
21FLBROW18	2/11/2004	30	13	22%
21FLBROW18	2/24/2005	30	14	24%
21FLWPB 42009012	3/30/2009	34	15	25%
21FLBROW18	8/10/2005	41	16	27%
21FLBROW17	8/11/2004	52	17	29%
21FLBROW17	11/17/2004	59	18	31%
21FLBROW17	3/4/2009	59	19	32%
21FLWPB 28030526	8/31/2009	60	20	34%
21FLBROW18	8/13/2003	67	21	36%
21FLWPB 42009011	3/30/2009	68	22	38%
21FLWPB 42009012	8/31/2009	70	23	39%
21FLBROW17	8/10/2005	74	24	41%
21FLBROW17	2/21/2007	74	25	43%
21FLBROW18	2/5/2003	74	26	45%
21FLWPB 42009012	6/25/2009	76	27	46%
21FLBROW17	10/28/2009	89	28	48%
21FLWPB 28030526	6/25/2009	94	29	50%
21FLBROW17	8/6/2008	96	30	52%
21FLBROW17	2/11/2004	110	31	54%
21FLBROW17	11/30/2005	110	32	55%
21FLWPB 42009011	6/25/2009	131	33	57%
21FLBROW18	5/5/2004	150	34	59%
21FLBROW18	11/30/2005	160	35	61%
21FLBROW17	5/14/2008	180	36	62%
21FLWPB 42009011	8/31/2009	220	37	64%
21FLBROW17	2/18/2008	240	38	66%
21FLBROW17	5/5/2004	280	39	68%
21FLBROW17	8/20/2007	280	40	69%
21FLGW 32985	7/2/2007	320	41	71%
21FLBROW17	11/30/2006	340	42	73%
21FLBROW17	8/24/2006	380	43	75%
21FLBROW17	2/3/2010	390	44	76%
21FLBROW17	5/31/2006	440	45	78%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW17	9/2/2009	490	46	80%
21FLWPB 42009011	11/24/2009	500	47	82%
21FLBROW18	6/2/2005	540	48	83%
21FLGW 20027	8/12/2003	570	49	85%
21FLBROW17	6/24/2009	650	50	87%
21FLWPB 42009011	11/3/2009	764	51	89%
21FLBROW17	8/13/2003	830	52	90%
21FLBROW17	6/2/2005	1600	53	92%
21FLBROW17	11/15/2007	1700	54	94%
21FLBROW18	11/6/2003	5600	55	96%
21FLBROW17	5/16/2007	6800	56	97%
21FLBROW17	11/6/2003	7400	57	99%
-	-	-	Existing condition concentration–90th percentile (counts/100mL)	830
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	52

Table 5.8e. Calculation of Fecal Coliform Reductions for the New River (North Fork) (WBID 3276A) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW16	3/4/2009	150	1	1%
21FLBROW16	2/24/2005	160	2	3%
21FLBROW64	2/24/2005	180	3	5%
21FLBROW64	3/4/2009	200	4	7%
21FLBROW64	2/23/2006	300	5	8%
21FLBROW16	2/21/2007	310	6	10%
21FLBROW64	4/24/2003	340	7	12%
21FLBROW64	11/17/2004	340	8	14%
21FLBROW64	5/14/2008	360	9	16%
21FLBROW16	8/11/2004	370	10	18%
21FLBROW16	11/17/2004	380	11	20%
21FLBROW16	4/24/2003	390	12	22%
21FLBROW16	2/11/2004	400	13	24%
21FLBROW16	8/6/2008	400	14	25%
21FLBROW64	6/2/2005	410	15	27%
21FLBROW64	8/11/2004	410	16	29%
21FLBROW16	5/14/2008	460	17	31%
21FLBROW16	2/23/2006	520	18	33%
21FLBROW64	2/21/2007	520	19	35%
21FLBROW64	2/3/2010	520	20	37%
21FLBROW64	5/5/2004	530	21	39%
21FLBROW64	10/28/2009	530	22	41%
21FLBROW16	5/5/2004	550	23	42%
21FLBROW16	5/31/2006	590	24	44%
21FLBROW16	5/16/2007	590	25	46%
21FLBROW64	11/30/2006	620	26	48%
21FLBROW64	5/31/2006	630	27	50%
21FLBROW16	2/5/2003	700	28	52%
21FLBROW16	8/13/2003	800	29	54%
21FLBROW16	11/30/2006	830	30	56%
21FLBROW16	2/3/2010	930	31	58%
21FLBROW64	8/6/2008	930	32	59%
21FLBROW64	2/18/2008	970	33	61%
21FLBROW16	10/28/2009	1000	34	63%
21FLBROW64	8/10/2005	1150	35	65%
21FLBROW16	6/24/2009	1200	36	67%
21FLBROW16	8/24/2006	1200	37	69%
21FLBROW16	8/20/2007	1200	38	71%
21FLBROW64	8/24/2006	1400	39	73%
21FLBROW16	8/11/2005	1600	40	75%
21FLBROW16	11/30/2005	1600	41	76%
21FLBROW64	8/20/2007	1800	42	78%
21FLBROW16	9/2/2009	1800	43	80%
21FLBROW16	2/18/2008	2100	44	82%
21FLBROW16	11/15/2007	2100	45	84%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW64	11/30/2005	2850	46	86%
21FLBROW64	11/15/2007	5200	47	88%
21FLBROW16	11/6/2003	6800	48	90%
21FLBROW64	9/2/2009	7600	49	92%
21FLBROW64	5/16/2007	7800	50	93%
21FLBROW16	6/2/2005	8400	51	95%
21FLBROW64	11/6/2003	8800	52	97%
21FLBROW64	6/24/2009	10000	53	99%
-	-	-	Existing condition concentration–90th percentile (counts/100mL)	6,800
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	94

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

Table 5.8f. Calculation of Fecal Coliform Reductions for the South Fork New River (WBID 3277A) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW90	4/24/2003	7	1	0%
21FLBROW90	3/4/2009	11	2	1%
21FLBROW90	5/14/2008	14.5	3	2%
21FLBROW90	5/5/2004	15	4	3%
21FLBROW90	2/23/2006	15	5	4%
21FLBROW90	11/30/2006	18.5	6	5%
21FLBROW19	3/4/2009	22	7	6%
21FLBROW20	3/4/2009	22	8	7%
21FLBROW90	10/28/2009	25.5	9	8%
21FLBROW90	5/16/2007	29.5	10	9%
21FLBROW90	8/6/2008	33.5	11	9%
21FLBROW90	2/5/2003	37	12	10%
21FLBROW90	8/10/2005	37	13	11%
21FLBROW90	11/30/2005	37	14	12%
21FLBROW90	2/21/2007	41	15	13%
21FLBROW90	8/11/2004	44	16	14%
21FLBROW20	8/6/2008	48	17	15%
21FLBROW15	4/24/2003	52	18	16%
21FLBROW15	5/14/2008	52	19	17%
21FLBROW15	3/4/2009	59	20	18%
21FLBROW90	5/31/2006	59	21	18%
21FLBROW19	2/23/2006	67	22	19%
21FLBROW20	5/14/2008	67	23	20%
21FLBROW15	2/5/2003	74	24	21%
21FLBROW19	5/14/2008	74	25	22%
21FLBROW20	11/30/2006	89	26	23%
21FLBROW15	2/23/2006	92.5	27	24%
21FLBROW90	2/18/2008	94.5	28	25%
21FLBROW15	8/6/2008	96	29	26%
21FLBROW19	8/10/2005	96	30	27%
21FLBROW90	11/17/2004	96	31	27%
21FLBROW15	2/21/2007	100	32	28%
21FLBROW20	8/10/2005	100	33	29%
21FLBROW20	8/13/2003	110	34	30%
21FLBROW19	5/5/2004	120	35	31%
21FLBROW19	4/24/2003	130	36	32%
21FLBROW19	8/13/2003	130	37	33%
21FLBROW19	2/21/2007	130	38	34%
21FLBROW20	8/20/2007	130	39	35%
21FLBROW19	8/6/2008	140	40	36%
21FLBROW20	2/24/2005	140	41	36%
21FLBROW19	5/31/2006	160	42	37%
21FLBROW90	2/11/2004	160	43	38%
21FLBROW90	2/24/2005	160	44	39%
21FLBROW20	4/24/2003	180	45	40%

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

21FLBROW20	11/17/2004	180	46	41%
21FLBROW20	2/21/2007	180	47	42%
21FLBROW20	5/5/2004	190	48	43%
21FLBROW20	8/11/2004	190	49	44%
21FLBROW90	9/2/2009	190	50	45%
21FLBROW20	11/30/2005	200	51	45%
21FLBROW15	11/17/2004	210	52	46%
21FLBROW19	11/30/2005	210	53	47%
21FLBROW90	11/15/2007	210	54	48%
21FLBROW15	8/13/2003	220	55	49%
21FLBROW19	2/5/2003	220	56	50%
21FLBROW19	8/11/2004	220	57	51%
21FLBROW19	11/17/2004	230	58	52%
21FLBROW20	2/18/2008	230	59	53%
21FLBROW19	8/20/2007	240	60	54%
21FLBROW90	8/13/2003	240	61	55%
21FLBROW19	2/18/2008	260	62	55%
21FLBROW20	6/2/2005	260	63	56%
21FLBROW15	11/30/2005	270	64	57%
21FLBROW15	8/11/2005	290	65	58%
21FLBROW19	2/24/2005	290	66	59%
21FLGW 34132	10/2/2007	290	67	60%
21FLBROW15	5/5/2004	300	68	61%
21FLBROW15	2/24/2005	310	69	62%
21FLBROW20	10/28/2009	310	70	63%
21FLBROW15	2/11/2004	320	71	64%
21FLBROW19	11/15/2007	340	72	64%
21FLBROW90	8/20/2007	355	73	65%
21FLBROW19	11/30/2006	360	74	66%
21FLBROW15	10/28/2009	370	75	67%
21FLBROW15	5/31/2006	380	76	68%
21FLBROW20	2/5/2003	380	77	69%
21FLBROW15	11/30/2006	390	78	70%
21FLBROW15	11/15/2007	390	79	71%
21FLBROW15	2/18/2008	390	80	72%
21FLBROW90	6/2/2005	390	81	73%
21FLBROW20	5/16/2007	460	82	73%
21FLBROW15	8/11/2004	480	83	74%
21FLBROW19	8/24/2006	480	84	75%
21FLBROW20	11/15/2007	510	85	76%
21FLBROW15	9/2/2009	530	86	77%
21FLBROW15	8/20/2007	540	87	78%
21FLBROW19	9/2/2009	550	88	79%
21FLBROW19	2/3/2010	580	89	80%
21FLBROW15	8/24/2006	610	90	81%
21FLBROW20	2/23/2006	640	91	82%
21FLBROW15	2/3/2010	660	92	82%
21FLBROW19	10/28/2009	680	93	83%
21FLBROW90	2/3/2010	1065	94	84%
21FLBROW20	2/3/2010	1100	95	85%
21FLBROW20	11/6/2003	1200	96	86%
21FLBROW15	6/24/2009	1300	97	87%
21FLBROW20	8/24/2006	1300	98	88%
21FLBROW20	9/2/2009	1300	99	89%
21FLBROW90	11/6/2003	1300	100	90%
21FLBROW15	5/16/2007	1600	101	91%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW90	8/24/2006	1700	102	91%
21FLBROW20	6/24/2009	1900	103	92%
21FLBROW15	6/2/2005	2200	104	93%
21FLBROW19	6/24/2009	4800	105	94%
21FLBROW20	5/31/2006	4800	106	95%
21FLBROW19	6/2/2005	5400	107	96%
21FLBROW19	5/16/2007	5600	108	97%
21FLBROW15	11/6/2003	5800	109	98%
21FLBROW90	6/24/2009	6000	110	99%
21FLBROW19	11/6/2003	6400	111	100%
-	-	-	Existing condition concentration-90th percentile (counts/100mL)	1,300
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	69

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

**Table 5.8g. Calculation of Fecal Coliform Reductions for the North
New River Canal (WBID 3277C) TMDL Based on the Hazen
Method**

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

.- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW23	2/21/2006	1.8	1	1%
21FLBROW23	4/24/2003	1.8	2	2%
21FLBROW21	2/6/2003	7	3	3%
21FLBROW23	2/23/2005	7	4	4%
21FLBROW23	2/12/2004	15	5	5%
21FLBROW21	8/28/2003	15	6	7%
21FLBROW23	11/28/2006	15	7	8%
21FLBROW23	3/3/2009	22	8	9%
21FLBROW22	12/1/2005	22	9	10%
21FLBROW23	12/1/2005	22	10	11%
21FLBROW23	2/6/2003	30	11	13%
21FLBROW23	2/20/2007	30	12	14%
21FLBROW23	2/19/2008	30	13	15%
21FLBROW23	5/30/2006	30	14	16%
21FLBROW22	11/18/2004	30	15	17%
21FLBROW21	12/1/2005	30	16	18%
21FLBROW22	2/6/2003	37	17	20%
21FLBROW23	5/15/2007	37	18	21%
21FLBROW23	8/5/2008	37	19	22%
21FLBROW22	10/28/2009	37	20	23%
21FLBROW23	11/18/2004	37	21	24%
21FLBROW21	2/12/2004	44	22	26%
21FLBROW22	2/23/2005	44	23	27%
21FLBROW21	2/18/2008	44	24	28%
21FLBROW21	3/4/2009	44	25	29%
21FLBROW21	11/18/2004	44	26	30%
21FLBROW23	11/13/2007	44	27	32%
21FLBROW21	2/23/2006	48	28	33%
21FLBROW22	2/21/2007	52	29	34%
21FLBROW22	3/4/2009	52	30	35%
21FLBROW22	2/12/2004	59	31	36%
21FLBROW21	2/23/2005	59	32	38%
21FLBROW22	2/20/2008	59	33	39%
21FLBROW23	5/13/2008	59	34	40%
21FLBROW21	8/6/2008	59	35	41%
21FLBROW21	2/21/2007	67	36	42%
21FLBROW21	10/28/2009	81	37	43%
21FLBROW22	2/23/2006	89	38	45%
21FLBROW23	5/6/2004	89	39	46%
21FLBROW21	5/31/2006	89	40	47%
21FLBROW23	8/12/2004	89	41	48%
21FLBROW21	11/5/2003	96	42	49%
21FLBROW21	4/24/2003	100	43	51%
21FLBROW22	8/10/2005	100	44	52%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW21	8/10/2005	100	45	53%
21FLBROW23	8/21/2007	100	46	54%
21FLBROW22	5/14/2008	110	47	55%
21FLBROW23	6/8/2005	120	48	57%
21FLBROW23	8/10/2005	130	49	58%
21FLBROW23	6/23/2009	150	50	59%
21FLBROW21	8/12/2004	150	51	60%
21FLBROW22	11/30/2006	150	52	61%
21FLBROW22	11/15/2007	160	53	63%
21FLBROW21	11/15/2007	160	54	64%
21FLBROW22	4/24/2003	180	55	65%
21FLBROW22	8/6/2008	200	56	66%
21FLBROW23	11/5/2003	200	57	67%
21FLBROW22	8/12/2004	210	58	68%
21FLBROW21	5/14/2008	230	59	70%
21FLBROW23	9/1/2009	230	60	71%
21FLBROW22	11/5/2003	260	61	72%
21FLBROW23	2/2/2010	270	62	73%
21FLBROW22	6/8/2005	280	63	74%
21FLBROW23	8/28/2003	290	64	76%
21FLBROW22	8/24/2006	290	65	77%
21FLBROW23	8/22/2006	290	66	78%
21FLBROW22	9/2/2009	310	67	79%
21FLBROW23	10/27/2009	320	68	80%
21FLBROW21	5/6/2004	430	69	82%
21FLGW 32963	7/2/2007	460	70	83%
21FLBROW21	11/30/2006	470	71	84%
21FLBROW21	8/24/2006	500	72	85%
21FLBROW21	5/16/2007	530	73	86%
21FLBROW21	6/8/2005	550	74	88%
21FLBROW21	8/20/2007	550	75	89%
21FLBROW22	8/28/2003	580	76	90%
21FLBROW21	9/2/2009	590	77	91%
21FLBROW22	2/3/2010	600	78	92%
21FLBROW21	6/24/2009	610	79	93%
21FLBROW21	2/3/2010	800	80	95%
21FLBROW22	6/1/2006	1300	81	96%
21FLBROW22	6/24/2009	1700	82	97%
21FLBROW22	5/6/2004	1800	83	98%
21FLBROW22	5/16/2007	5800	84	99%
-	-	-	Existing condition concentration—90th percentile (counts/100mL)	580
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	31

Table 5.8h. Calculation of Fecal Coliform Reductions for the Dania Cut-off Canal (WBID 3277E) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW24	5/14/2008	1.8	1	1%
21FLBROW47	5/6/2004	7	2	2%
21FLBROW47	8/11/2005	7	3	4%
21FLBROW47	2/6/2003	15	4	5%
21FLBROW47	2/24/2005	22	5	7%
21FLBROW24	4/24/2003	22	6	8%
21FLBROW47	4/24/2003	22	7	10%
21FLBROW26	3/4/2009	37	8	11%
21FLBROW47	11/18/2004	37	9	13%
21FLBROW24	5/6/2004	44	10	14%
21FLBROW26	5/14/2008	52	11	16%
21FLBROW24	2/23/2005	59	12	17%
21FLBROW47	8/11/2004	63	13	19%
21FLBROW24	2/12/2004	81	14	20%
21FLBROW26	4/24/2003	81	15	22%
21FLBROW24	8/12/2004	81	16	23%
21FLBROW26	5/6/2004	89	17	25%
21FLBROW47	12/1/2005	89	18	26%
21FLBROW24	2/6/2003	96	19	28%
21FLBROW47	8/13/2003	96	20	29%
21FLBROW24	10/28/2009	120	21	31%
21FLBROW26	2/23/2005	130	22	32%
21FLBROW24	2/23/2006	130	23	34%
21FLBROW24	11/30/2006	140	24	35%
21FLBROW24	8/22/2007	160	25	37%
21FLBROW24	3/4/2009	180	26	38%
21FLBROW26	2/21/2007	190	27	40%
21FLBROW24	8/28/2003	200	28	41%
21FLBROW26	2/12/2004	210	29	43%
21FLBROW26	10/28/2009	210	30	44%
21FLBROW26	2/6/2003	240	31	46%
21FLBROW24	8/6/2008	240	32	47%
21FLBROW24	8/24/2006	250	33	49%
21FLBROW26	8/22/2007	250	34	50%
21FLBROW24	11/18/2004	250	35	51%
21FLBROW24	2/21/2007	260	36	53%
21FLBROW24	2/20/2008	260	37	54%
21FLBROW24	8/11/2005	260	38	56%
21FLBROW26	11/18/2004	270	39	57%
21FLBROW26	8/6/2008	280	40	59%
21FLBROW26	8/11/2005	290	41	60%
21FLBROW47	11/5/2003	350	42	62%
21FLBROW24	12/1/2005	360	43	63%
21FLBROW26	12/1/2005	360	44	65%
21FLBROW47	2/12/2004	390	45	66%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLBROW26	2/23/2006	390	46	68%
21FLBROW26	8/24/2006	390	47	69%
21FLBROW26	11/30/2006	390	48	71%
21FLBROW24	6/1/2006	400	49	72%
21FLBROW24	9/2/2009	410	50	74%
21FLBROW26	11/15/2007	410	51	75%
21FLBROW26	2/20/2008	420	52	77%
21FLBROW26	5/16/2007	450	53	78%
21FLBROW26	8/28/2003	460	54	80%
21FLBROW26	6/1/2006	830	55	81%
21FLBROW24	2/3/2010	1000	56	83%
21FLBROW26	6/8/2005	1100	57	84%
21FLBROW24	6/24/2009	1300	58	86%
21FLBROW26	9/2/2009	1600	59	87%
21FLBROW24	6/8/2005	1800	60	89%
21FLBROW24	11/15/2007	1800	61	90%
21FLBROW26	8/12/2004	3200	62	92%
21FLBROW24	11/6/2003	4200	63	93%
21FLBROW24	5/16/2007	5200	64	95%
21FLBROW26	6/24/2009	5200	65	96%
21FLBROW26	2/3/2010	7800	66	98%
21FLBROW26	11/6/2003	9400	67	99%
-	-	-	Existing condition concentration-90th percentile (counts/100mL)	1,800
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	78

**Table 5.8i. Calculation of Fecal Coliform Reductions for the South
New River Canal (C-11) (WBID 3279) TMDL Based on the
Hazen Method**

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW29	2/21/2006	1.8	1	1%
21FLBROW28	2/21/2007	7	2	2%
21FLBROW29	11/18/2004	7	3	3%
21FLBROW29	3/3/2009	7	4	5%
21FLBROW29	2/20/2007	11	5	6%
21FLBROW29	2/6/2003	15	6	7%
21FLBROW29	2/23/2005	15	7	9%
21FLBROW29	2/19/2008	15	8	10%
21FLBROW28	2/23/2006	22	9	11%
21FLBROW29	2/12/2004	26	10	13%
21FLBROW28	12/1/2005	30	11	14%
21FLBROW28	3/4/2009	30	12	16%
21FLBROW29	4/24/2003	30	13	17%
21FLBROW28	2/20/2008	37	14	18%
21FLBROW29	11/28/2006	40.5	15	20%
21FLGW 35003	7/10/2008	41	16	21%
21FLGW 34129	10/23/2007	50	17	22%
21FLGW 34115	10/23/2007	51	18	24%
21FLBROW28	2/6/2003	59	19	25%
21FLBROW28	2/12/2004	59	20	26%
21FLBROW28	11/18/2004	67	21	28%
21FLBROW28	2/23/2005	67	22	29%
21FLBROW29	5/15/2007	70	23	30%
21FLBROW28	11/30/2006	74	24	32%
21FLBROW29	5/13/2008	74	25	33%
21FLBROW29	12/1/2005	81	26	34%
21FLBROW29	11/13/2007	81	27	36%
21FLGW 20031	8/25/2003	100	28	37%
21FLBROW29	10/27/2009	110	29	39%
21FLBROW29	5/30/2006	120	30	40%
21FLBROW28	4/24/2003	130	31	41%
21FLBROW29	8/21/2007	160	32	43%
21FLBROW28	10/28/2009	170	33	44%
21FLSFWMC1103.3TS	7/28/2008	172	34	45%
21FLBROW28	6/1/2006	190	35	47%
21FLGW 17413	6/5/2003	200	36	48%
21FLGW 34123	10/24/2007	200	37	49%
21FLBROW28	11/15/2007	210	38	51%
21FLBROW29	6/8/2005	210	39	52%
21FLBROW28	5/14/2008	230	40	53%
21FLBROW29	8/12/2004	240	41	55%
21FLGW 34135	10/29/2007	250	42	56%
21FLBROW29	8/10/2005	260	43	57%
21FLBROW28	5/6/2004	270	44	59%
21FLBROW29	9/1/2009	280	45	60%

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

21FLSFWMC1104.3TS	7/28/2008	280	46	61%
21FLBROW29	8/22/2006	305	47	63%
21FLSFWMC1102.1TS	7/28/2008	310	48	64%
21FLBROW28	11/6/2003	340	49	66%
21FLGW 17405	6/5/2003	340	50	67%
21FLSFWMC1102.8TS	7/28/2008	360	51	68%
21FLBROW28	8/11/2005	370	52	70%
21FLBROW29	5/6/2004	370	53	71%
21FLBROW29	8/5/2008	430	54	72%
21FLSFWMC1102.0TS	7/28/2008	430	55	74%
21FLGW 17429	6/12/2003	440	56	75%
21FLBROW29	8/28/2003	450	57	76%
21FLBROW28	8/12/2004	460	58	78%
21FLBROW28	8/22/2007	460	59	79%
21FLBROW28	8/28/2003	470	60	80%
21FLBROW28	6/8/2005	490	61	82%
21FLGW 34116	10/2/2007	490	62	83%
21FLGW 32965	7/5/2007	500	63	84%
21FLBROW28	8/24/2006	510	64	86%
21FLSFWMC1104.6TS	7/28/2008	530	65	87%
21FLBROW28	8/6/2008	580	66	89%
21FLBROW29	6/23/2009	580	67	90%
21FLBROW28	6/24/2009	590	68	91%
21FLBROW29	11/5/2003	670	69	93%
21FLBROW28	9/2/2009	700	70	94%
21FLBROW28	5/16/2007	1500	71	95%
21FLGW 32968	7/5/2007	2000	72	97%
21FLBROW28	2/3/2010	8400	73	98%
21FLBROW29	2/2/2010	9800	74	99%
-	-	-	Existing condition concentration—90th percentile (counts/100mL)	580
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	31

Table 5.8j. Calculation of Fecal Coliform Reductions for the C-11 East (South New River) Canal (WBID 3281) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the Station, Column 2 lists the Sample Collection Date, Column 3 lists the fecal coliform existing concentration (counts/100mL), Column 4 lists the concentration rank, and Column 5 lists the concentration percentile.

= Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW27	2/23/2005	44	1	2%
21FLBROW27	2/23/2006	89	2	5%
21FLBROW27	4/24/2003	100	3	8%
21FLBROW27	11/18/2004	100	4	12%
21FLBROW27	2/21/2007	110	5	15%
21FLBROW27	5/14/2008	123	6	18%
21FLBROW27	2/12/2004	140	7	22%
21FLBROW27	3/4/2009	140	8	25%
21FLBROW27	2/20/2008	160	9	28%
21FLBROW27	8/12/2004	220	10	32%
21FLBROW27	12/1/2005	250	11	35%
21FLGW 32982	7/2/2007	280	12	38%
21FLBROW27	8/28/2003	290	13	42%
21FLBROW27	11/30/2006	305	14	45%
21FLBROW27	2/6/2003	400	15	48%
21FLBROW27	5/6/2004	400	16	52%
21FLBROW27	10/28/2009	420	17	55%
21FLGW 34119	10/2/2007	430	18	58%
21FLBROW27	8/22/2007	590	19	62%
21FLBROW27	8/6/2008	665	20	65%
21FLBROW27	6/1/2006	950	21	68%
21FLBROW27	8/24/2006	1400	22	72%
21FLBROW27	9/2/2009	1400	23	75%
21FLBROW27	6/8/2005	1800	24	78%
21FLBROW27	8/11/2005	1800	25	82%
21FLBROW27	11/15/2007	1800	26	85%
21FLBROW27	11/6/2003	4400	27	88%
21FLBROW27	2/3/2010	6950	28	92%
21FLBROW27	6/24/2009	7600	29	95%
21FLBROW27	5/16/2007	9100	30	98%
-	-	-	Existing condition concentration—90th percentile (counts/100mL)	5,675
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	93

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\text{TMDL} \cong \sum \text{WLAs}_{\text{wastewater}} + \sum \text{WLAs}_{\text{NPDES Stormwater}} + \sum \text{LAs} + \text{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDLs for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281 are expressed as a percent reduction, and represents the maximum daily fecal coliform load the stream can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

6.2 Load Allocation

Based on a percent reduction approach, the LA for percent reduction in fecal coliform from nonpoint sources for each WBID is presented in **Table 6.1**. It should be noted that the LA

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A**).

Table 6.1. TMDL Components for Fecal Coliform in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281

This is an eight-column table. Column 1 lists WBIDs, Column 2 lists waterbody name, Column 3 lists the parameter, Column 4 lists the TMDL (counts/100mL), Column 5 lists the WLA for wastewater (counts/100mL), Column 6 lists the WLA for NPDES stormwater (percent reduction), Column 7 lists the LA (percent reduction), and Column 8 lists the MOS.

^{*}N/A = WLA for Wastewater is not applicable as permitted facilities discharge outside of WBID boundaries

¹N/A = Not applicable

WBID	Waterbody Name	Parameter	TMDL (counts/100mL)	WLA for Wastewater (counts/100mL)	WLA for NPDES Stormwater (%)	LA (%)	MOS
3270	C-14 (Cypress Creek Canal)	Fecal coliform	400	N/A [*]	22	22	Implicit
3273	C-13 West (Middle River Canal)	Fecal coliform	400	N/A ¹	22	22	Implicit
3274	C-13 East (Middle River Canal)	Fecal coliform	400	N/A ¹	67	67	Implicit
3276	C-12	Fecal coliform	400	N/A ¹	52	52	Implicit
3276A	New River (North Fork)	Fecal coliform	400	N/A ¹	94	94	Implicit
3277A	New River Canal (South)	Fecal coliform	400	N/A ¹	69	69	Implicit
3277C	North New River	Fecal coliform	400	N/A ¹	31	31	Implicit
3277E	Dania Cutoff Canal	Fecal coliform	400	NA ¹	78	78	Implicit
3279	South New River Canal (C-11)	Fecal coliform	400	N/A ¹	31	31	Implicit
3281	C-11 East	Fecal coliform	400	N/A [*]	93	93	Implicit

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

Several NPDES-permitted wastewater facilities were identified within the WBID boundaries (see **Table 4.1a**). Two of these facilities are Domestic Wastewater facilities, the Broward County North Regional WWTP and the Town of Davie WWTP (Permit Numbers FL0031771 and FL0040541, respectively); however, treated wastewater from both facilities is transported to the Atlantic Ocean via ocean outfalls and therefore, would not contribute to observed levels of fecal coliform bacteria within the WBID they are located.

It should be noted that the state requires all NPDES-permitted wastewater point source dischargers to meet bacteria criteria at the end of the pipe. It is the Department's current practice not to allow mixing zones for bacteria. Any future point sources that may discharge in the WBID in the future will also be required to meet end-of-pipe standards for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit percent reduction in current fecal coliform loading for each WBID presented in **Table 6.1**.

It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL by not subtracting contributions from natural sources and sediments when the percent reduction was calculated. This makes the estimation of human contribution more stringent and therefore adds to the MOS.

Chapter 7: TMDL IMPLEMENTATION

7.1 Basin Management Action Plan

Following the adoption of these TMDLs by rule, the Department will determine the best course of action regarding their implementation. Depending on the pollutant(s) causing the waterbody impairment and the significance of the waterbody, the Department will select the best course of action leading to the development of a plan to restore the waterbody. Often this will be accomplished cooperatively with stakeholders by creating a Basin Management Action Plan, referred to as the BMAP. BMAPs are the primary mechanism through which TMDLs are implemented in Florida (see Subsection 403.067[7], F.S.). A single BMAP may provide the conceptual plan for the restoration of one or many impaired waterbodies.

If the Department determines that a BMAP is needed to support the implementation of these TMDLs, a BMAP will be developed through a transparent, stakeholder-driven process intended to result in a plan that is cost-effective, technically feasible, and meets the restoration needs of the applicable waterbodies. Once adopted by order of the Department Secretary, BMAPs are enforceable through wastewater and municipal stormwater permits for point sources and through BMP implementation for nonpoint sources. Among other components, BMAPs typically include the following:

- *Water quality goals (based directly on the TMDL);*
- *Refined source identification;*
- *Load reduction requirements for stakeholders (quantitative detailed allocations, if technically feasible);*
- *A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach;*
- *A description of further research, data collection, or source identification needed in order to achieve the TMDL;*
- *Timetables for implementation;*
- *Implementation funding mechanisms;*
- *An evaluation of future increases in pollutant loading due to population growth;*
- *Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and*
- *Stakeholder statements of commitment (typically a local government resolution).*

BMAPs are updated through annual meetings and may be officially revised every five years. Completed BMAPs in the state have improved communication and cooperation among local stakeholders and state agencies; improved internal communication within local governments; applied high-quality science and local information in managing water resources; clarified the obligations of wastewater point source, MS4, and non-MS4 stakeholders in TMDL implementation; enhanced transparency in the Department's decision making; and built strong

relationships between the Department and local stakeholders that have benefited other program areas.

7.2 Other TMDL Implementation Tools

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody, such that it meets its designated uses. This is because fecal coliform impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Addressing these problems requires good old-fashioned detective work that is best done by those in the area.

Many assessment tools are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple (such as Walk the WBIDs and GIS mapping) to the complex (such as bacteria source tracking). Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River Tributaries and Hillsborough Basins, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work.

In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a road map for restoration activities, while still meeting the requirements of Subsection 403.067(7), F.S.

References

- Alderiso, K., D. Wait, and M. Sobsey. 1996. Detection and characterization of make-specific RNA coliphages in a New York City reservoir to distinguish between human and nonhuman sources of contamination. In: *Proceedings of a Symposium on New York City Water Supply Studies*, J.J. McDonnell et al. (eds.). TPS-96-2. Herndon, VA: American Water Resources Association.
- Broward County Department of Natural Resource Protection (BCDNRP). 1994. *Summary of Bacteriological Testing in the Las Olas Isles, July, 1993 through August, 1994*. Technical Report Series, TR 94-03.
- Broward County Department of Natural Resource Protection (BCDNRP). 1995. *Summary of Bacteriological Testing in the Las Olas Isles, August, 1994 through August, 1995*, Technical Report Series, TR 95-02.
- Broward County Department of Planning and Environmental Protection (BCDPEP). 2001a. *Broward County, Florida Historical Water Quality Atlas: 1972-1997*. Technical Report Series, TR: 01-03
- Broward County Department of Planning And Environmental Protection (BCDPEP). 2001b. *New River Restoration Plan Update: Activities and Accomplishments from 1991 to 2000*. Technical Report Series, TR: 01-01
- Broward County Planning and Redevelopment Division (BCPRD). 2003. *Quick Facts for Broward County*. Urban Planning and Redevelopment Planning Services Division. Available:
<http://www.broward.org/PlanningAndRedevelopment/DemographicsAndEconomics/Documents/bbtn2.pdf>
- Broward County Natural Resources Planning and Management Division (BCNRPMD). 2009. *Broward's County-wide Integrated Water Resources Plan (IWRP)*. Natural Resources Planning and Management Division Water Policy and Planning Program. Available:
<http://www.broward.org/IWRP/Documents/IntegratedWaterResourcePlan.pdf>
- Cooper, R.M. and J. Lane. 1987. An Atlas of Eastern Broward County Surface Water Management Basins. South Florida Water Management District. Technical Memorandum, DRE 231. West Palm Beach, Florida
- Culver, T.B., Y. Jia, R. TiKoo, J. Simsic, and R. Garwood. 2002. Development of the Total Maximum Daily Load (TMDL) for fecal coliform bacteria in Moore's Creek, Albemarle County, Virginia. Virginia Department of Environmental Quality.
- Fish, J.E.. 1988. *Hydrogeology, aquifer characteristics, and ground-water flow of the surficial aquifer system, Broward County, Florida*. U.S. Geological Survey Water-Resources Investigations Report 87-4034.

Florida Administrative Code. Rule 62-302, Surface water quality standards.

———. Rule 62-303, Identification of impaired surface waters.

Florida Atlantic University Visual Planning Technology Lab (FAU). My North Fork: *An Online Community Resource Center*. June 2010. Available:
<http://www.mynorthfork.fau.edu/default.htm>

Florida Department of Environmental Protection. February 2001. *A report to the Governor and the Legislature on the allocation of Total Maximum Daily Loads in Florida*. Tallahassee, FL: Bureau of Watershed Management.

Florida Watershed Restoration Act. *Chapter 99-223, Laws of Florida*.

Hazen and Sawyer. 2004. *Reuse Feasibility Study*. Prepared for Broward County Office of Environmental Services. May 2004.

Hunter, P.R. 2002. Does calculation of the 95th percentile of microbiological results offer any advantage over percentage exceedance in determining compliance with bathing water quality standards? *Applied Microbiology* (34): 283-286.

Jamieson, R.C., D.M. Joy, H. Lee, R. Kostaschuk, and R.J. Gordon. 2005. Resuspension of sediment-associated *Escherichia coli* in a natural stream. *Journal of Environmental Quality* (34): 581-589.

Koopman, B. et al. 2006. Ocean Outfall Study Final Report. Department of Environmental Engineering Sciences, University of Florida, Gainesville, Florida. Available:
<http://www.dep.state.fl.us/water/reuse/docs/OceanOutfallStudy.pdf>

Lim, S., and V. Olivieri. 1982. *Sources of microorganisms in urban runoff*. Johns Hopkins School of Public Health and Hygiene. Baltimore, MD: Jones Falls Urban Runoff Project.

Miller, James A. 1990. *Ground water Atlas of the United States Alabama, Florida, Georgia, and South Carolina: Biscayne Aquifer*, (HA 730-G). U.S. Geological Survey. Available:
http://pubs.usgs.gov/ha/ha730/ch_q/G-text6.html

Minnesota Pollution Control Agency. 1999. *Effect of septic systems on ground water quality*. Ground water and Assessment Program. Baxter, MN.

Schroeder, Melvin C., Klein, Howard and Hoy, Nevin D. 1956. *Biscayne aquifer in Dade and Broward Counties, Florida*. Tallahassee, FL. Florida Geological Survey, (Report of Investigations - Florida Geological Survey, 17)

Solo-Gabriele, H. M et al. 2002. Sources of *Escherichia coli* in a coastal subtropical environment. *Applied and Environmental Microbiology*. (68): 1165-1172.

- South Florida Water Management District (SFWMD). 2010. *Canals in South Florida: A Technical Support Document*. Available: http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/att%20%20canal%20science%20inventory.pdf
- South Florida Water Management District (SFWMD) website. 2010. *DBHYDRO Database*. Available: http://www.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_menu
- Trial, W. et al. 1993. Bacterial source tracking: studies in an urban Seattle watershed. *Puget Sound Notes* 30: 1-3.
- U.S. Census Bureau. 2000. Available: <http://www.census.gov/>
- U.S. EPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Water: Management Measures for Marinas and Recreational Boating*. Available: <http://www.epa.gov/owow/NPS/MMGI/Chapter5/ch5-1.html#Pathogen>
- U.S. Environmental Protection Agency. January 2001. *Protocol for developing pathogen TMDLs*. Washington, DC: Office of Water. EPA 841-R-00-002.
- U.S. EPA. 2010. *Stormwater Best Management Practices: Illicit Discharge Detection and Elimination: Sewage from Recreational Activities Fact Sheet*. Available: <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=27&minmeasure=3>
- van der Wel, B. 1995. Dog pollution. *The Magazine of the Hydrological Society of South Australia* 2(1) 1.
- Watson, T. June 6, 2002. Dog waste poses threat to water. *USA Today*.
- Weiskel, P.K., B.L Howes, and G.R. Heufflder. 1996. Coliform contamination of a coastal embayment: Sources and transport pathway. *Environmental Science and Technology* 1872-1881.
- Whitman, Dean. 1997. Notes on the geology and Water Resources of South Florida. Florida International University. Available: http://www2.fiu.edu/~whitmand/Courses/FI_geo_notes.html

Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, they have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and the master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focus on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Estimates of Fecal Coliform Loadings from Potential Sources

The Department provides these estimates for informational purposes only and did not use them to calculate the TMDL. These estimates are intended to give the public a general idea of the relative importance of each source in the waterbody. The estimates were based on the best information available to the Department when the calculation was made. The numbers provided do not represent the actual loadings from the sources.

Pets

Pets (especially dogs) could be a significant source of coliform pollution through surface runoff within the WBID boundaries. Studies report that up to 95 percent of the fecal coliform found in urban stormwater can have nonhuman origins (Alderiso et al., 1996; Trial et al., 1993).

The most important nonhuman fecal coliform contributors appear to be dogs and cats. In a highly urbanized Baltimore catchment, Lim and Olivieri (1982) found that dog feces were the single greatest source of fecal coliform and fecal strep bacteria. Trial et al. (1993) also reported that cats and dogs were the primary source of fecal coliform in urban subwatersheds. Using bacteria source tracking techniques, it was found in Stevenson Creek in Clearwater, Florida, that the amount of fecal coliform bacteria contributed by dogs was as important as that from septic tanks (Watson, 2002).

According to the American Pet Products Association (APPMA), about 4 out of 10 U.S. households include at least 1 dog. A single gram of dog feces contains about 2.2 million fecal coliform bacteria (van der Wel, 1995). Unfortunately, statistics show that about 40 percent of American dog owners do not pick up their dogs' feces. The number of dogs within the WBID boundaries is unknown. Therefore, the statistics produced by APPMA were used in this analysis to estimate the possible fecal coliform loads contributed by dogs.

Using information from the Florida Department of Revenue's (DOR) 2009 Cadastral tax parcel and ownership coverage contained in the Department's geographic information system (GIS) library, residential parcels were identified using DOR's residential land use codes. The final number of households within the WBID boundary was calculated by adding the number residential units on the parcels for all improved residential land use codes. The estimated number of households within each of the WBID boundaries is shown in **Table B.1**.

Table B.1 also shows the estimated number of dogs within each WBID boundary, assuming that 40 percent of the households in these areas have 1 dog; the total waste produced (grams/day) by dogs and left on the land surface in residential areas in the WBIDs, assuming that 40 percent of dog owners do not pick up their dogs' feces; and the total load of fecal coliform produced by dogs (counts/day) within each WBID boundary.

It should be noted that these loads only represents the fecal coliform load created in the WBIDs and is not intended to be used to represent a part of the existing load that reaches the receiving waterbodies. The fecal coliform load that eventually reaches the receiving waterbodies could be significantly less than this value due to attenuation in overland transport.

Table B.1. Estimated Number of Households and Dogs, Waste Produced (grams/day) by Dogs Left on the Land Surface and Total Load of Fecal Coliform (counts/day) Produced by Dogs within each WBID Boundary

This is a five-column table. Column 1 lists the WBID number, Column 2 lists the number of households, Column 3 lists the number of dogs, Column 4 lists the waste produced left on land, and Column 5 lists the fecal coliform loading.

WBID	# Households	# Dogs	Waste Produced Left on Land Surface (grams/day)	Loading (counts/day)
3270	76,153	30,461	5,483,016	1.21×10^{13}
3273	38,158	15,263	2,747,376	6.04×10^{12}
3274	27,856	11,142	2,005,632	4.41×10^{12}
3276	18,667	7,467	1,344,024	2.96×10^{12}
3276A	16,753	6,701	1,206,216	2.65×10^{12}
3277A	26,045	10,418	1,875,240	4.13×10^{12}
3277C	6,404	2,562	461,088	1.01×10^{12}
3277E	8,303	3,321	597,816	1.32×10^{12}
3279	46,323	18,529	3,335,256	7.34×10^{12}
3281	25,263	10,105	1,818,936	4.00×10^{12}

Table B.2 shows the waste production rate for a dog (450 grams/animal/day) and the fecal coliform counts per gram of dog waste (2,200,000 counts/gram).

Table B.2. Dog Population Density, Wasteload and Fecal Coliform Density Based on the Literature (Weiskel et al., 1996)

This is a four-column table. Column 1 lists the animal type (dog), Column 2 lists the population density, Column 3 lists the wasteload per dog per day, and Column 4 lists the fecal coliform density per gram of dog feces.

- = Empty cell/no data

* Number from APPA

Animal Type	Population Density (animals/household)	Wasteload (grams/animal-day)	Fecal Coliform Density (counts/gram)
Dog	0.4*	450	2,200,000

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) can also be a potential source of fecal bacteria pollution. Human sewage can be introduced into surface waters even when storm and sanitary sewers are separated. Leaks and overflows are common in many older sanitary sewers where capacity is exceeded, high rates of infiltration and inflow occur (i.e., outside water gets into pipes, reducing capacity), frequent blockages occur, or sewers are simply falling apart due to poor joints or pipe materials. Power failures at pumping stations are also a common cause of SSOs. The greatest risk of an SSO occurs during storm events; however, few comprehensive data are available to quantify SSO frequency and bacteria loads in most watersheds. Therefore, in this report, the possible fecal coliform load contributed by sewer line leakage was estimated based on an empirical leakage rate of 0.5 percent of the total raw sewage (Culver et al., 2002) created within the WBID by the households connected to the sewer system.

The estimated number of properties connected to the sewer system was based on data obtained from the Florida Department of Health's (FDOH) ongoing inventory of wastewater treatment and disposal method for developed properties. Using information from the DOR's 2009 Cadastral tax parcel and ownership coverage, residential parcels were identified using DOR's land use codes. The final number of households within the WBID boundary was calculated by adding the number residential units on the parcels for all improved residential land use codes (see **Table B.1**). **Table B.3** shows the estimated number of households (*N*) within the WBID boundaries served by sewer systems (**Figure B.1**).

Fecal coliform loading from sewer line leakage can be calculated based on the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5 percent (Culver et al., 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs within the WBID boundaries can be made using **Equation B.1**.

$$L = 37.85 * N * Q * C * F$$

Equation B.1

Where:

- L* is the fecal coliform daily load (counts/day);
- N* is the number of households using sanitary sewer in the WBID;
- Q* is the discharge rate for each household (gallons/day);
- C* is the fecal coliform concentration for domestic wastewater (counts/100mL);
- F* is the sewer line leakage rate; and
- 37.85 is a conversion factor (100mL/gallon).

The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size for Broward County (2.45) (US Census Bureau, 2000) by the per capita wastewater production rate per day (70 gallons/day/person). The commonly cited concentration (*C*) for domestic wastewater is 1×10^6 counts/100 mL for fecal coliform (EPA, 2001). The contribution of fecal coliform through sewer line leakage was assumed to be 0.5 percent of the total sewage loading created from the population not on septic tanks (Culver et al., 2002). Based on **Equation B.1**, the approximate fecal coliform loading from sewer line leakage in each the WBID is summarized in **Table B.3**.

Table B.3. Estimated Number of Households Served by Sanitary Sewers and Estimated Fecal Coliform Loading from Sewer Line Leakage within each WBID Boundary

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the number of households served by sanitary sewers, Column 3 lists the sanitary sewer loading

WBID	# of Households Served by Sanitary Sewers	Sanitary Sewer (counts/day)
3270	75,917	2.5×10^{12}
3273	38,145	1.2×10^{12}
3274	27,467	8.9×10^{11}
3276	18,476	6.0×10^{11}
3276A	16,010	5.2×10^{11}
3277A	24,636	8.0×10^{11}
3277C	5,780	1.9×10^{11}
3277E	7,730	2.5×10^{11}
3279	44,866	1.5×10^{12}
3281	23,561	7.6×10^{11}

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

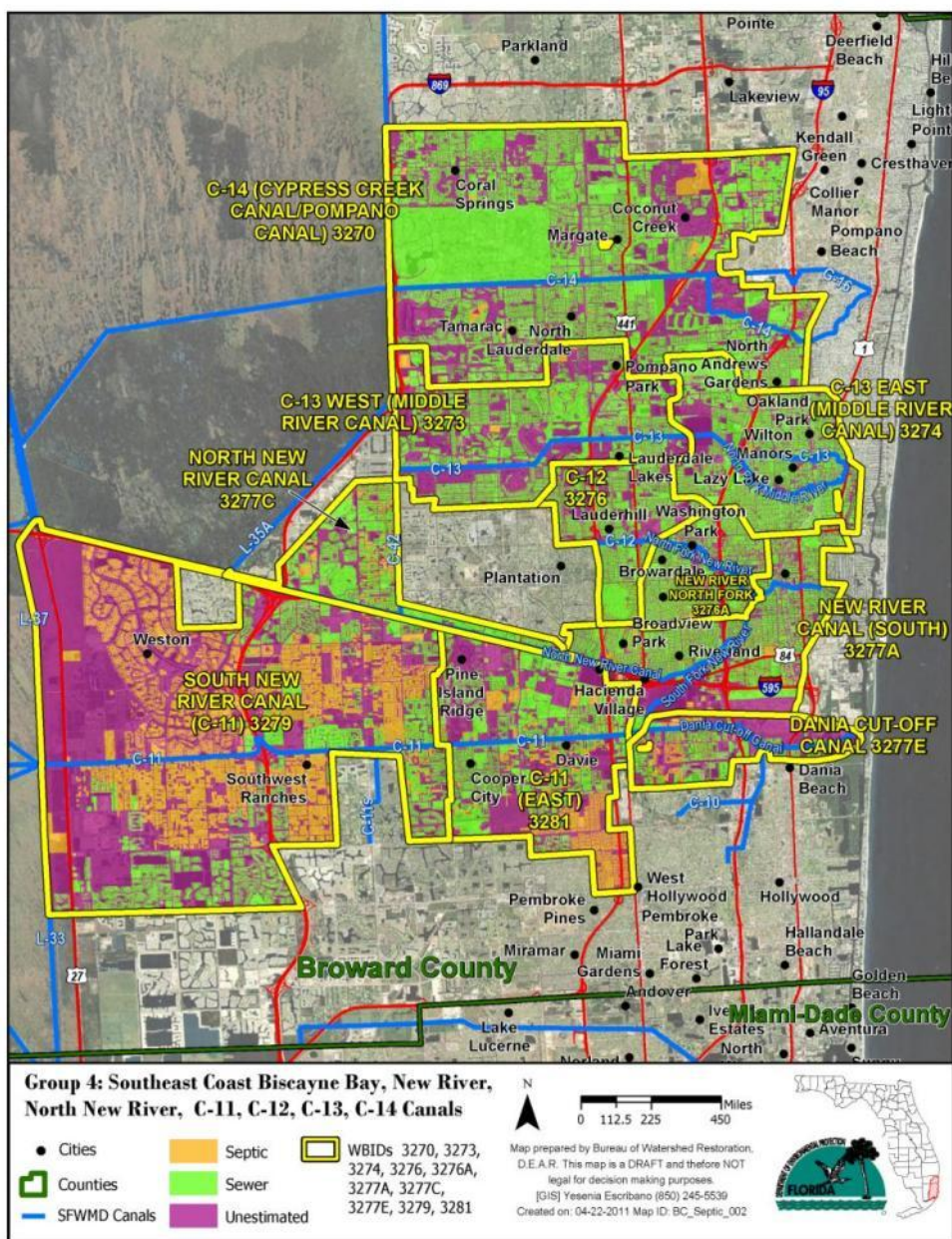


Figure B.1. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) within the C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cutoff Canal (WBID 3277E), South New River Canal (C-11) (WBID 3279) and C-11 East (WBID 3281) WBID Boundaries

Septic Tanks

Septic tanks are another potentially important source of coliform pollution in urban watersheds. When properly installed, most of the coliform from septic tanks should be removed within 50 meters of the drainage field (Minnesota Pollution Control Agency, 1999). However, the physical properties of an aquifer, such as thickness, sediment type (sand, silt, and clay), and location play a large part in determining whether contaminants from the land surface will reach the ground water (USGS, 2010). The risk of contamination is greater for unconfined (water-table) aquifers than for confined aquifers because they usually are nearer to land surface and lack an overlying confining layer to impede the movement of contaminants (USGS, 2010).

Sediment type (sand, silt, and clay) also determines the risk of contamination in a particular watershed. "Porosity, which is the proportion of a volume of rock or soil that consists of open spaces, tells us how much water rock or soil can retain. Permeability is a measure of how easily water can travel through porous soil or bedrock. Soil and loose sediments, such as sand and gravel, are porous and permeable. They can hold a lot of water, and it flows easily through them. Although clay and shale are porous and can hold a lot of water, the pores in these fine-grained materials are so small that water flows very slowly through them. Clay has a low permeability (USGS, 2010)."

Also, the risk of contamination is increased for areas with a relatively high ground water table. The drain field can be flooded during the rainy season, resulting in ponding and coliform bacteria can pollute the surface water through stormwater runoff. Additionally, in these circumstances, a high water table can result in coliform bacteria pollution reaching the receiving waters through baseflow.

Septic tanks may also cause coliform pollution when they are built too close to irrigation wells. Any well that is installed in the surficial aquifer system will cause a drawdown. If the septic tank system is built too close to the well (e.g., less than 75 feet), the septic tank discharge will be within the cone of influence of the well. As a result, septic tank effluent may enter the well, and once the polluted water is used to irrigate lawns, coliform bacteria may reach the land surface and wash into surface waters through stormwater runoff.

A rough estimate of fecal coliform loads from failed septic tanks within the WBID boundaries can be made using **Equation B.2**:

$$L = 37.85 * N * Q * C * F$$

Equation B.2

Where:

L is the fecal coliform daily load (counts/day);
N is the number of households using septic tanks in the WBID;
Q is the discharge rate for each septic tank (gallons/day);
C is the fecal coliform concentration for the septic tank discharge (counts/100mL);
F is the septic tank failure rate; and
37.85 is a conversion factor (100mL/gallon).

Based on the estimated total number of households within each WBID (**Table B.2**) and the estimated number of households connected to the sewer system (**Table B.3**), the number of housing units (N) within each WBID boundary thought to be using septic tanks to treat their domestic wastewater is shown in **Table B.4 (Figure B.1)**.

The discharge rate from each septic tank (Q) was calculated by multiplying the average household size by the per capita wastewater production rate per day. Based on the information published by the Census Bureau, the average household size for Broward County is about 2.45 people/household. The same population densities were assumed within each WBID boundary. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA, 2001). The commonly cited concentration (C) for septic tank discharge is 1×10^6 counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the WBID when this TMDL was developed. Therefore, the failure rate was derived from the number of septic tanks in Broward County based on FDOH's septic tank inventory and the number of septic tank repair permits issued in both counties as published by FDOH (available: <http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm>). The cumulative number of septic tanks in Broward County on an annual basis was calculated by subtracting the number of issued septic tank installation permits for each year from the current number of septic tanks in the county based on FDOH's 2009-2010 inventory, assuming that none of the installed septic tanks will be removed after being installed (**Table B.5**). The reported number of septic tank repair permits was also obtained from the FDOH Website.

Based on this information, the annual discovery rates of failed septic tanks were calculated (**Table B.5**). The average annual septic tank failure discovery rate for Broward County is approximately 0.66 percent. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 3.32 percent for Broward County. **Table B.4** shows the estimated fecal coliform loading from failed septic tanks within each WBID boundary based on **Equation B.2**.

Table B.4. Estimated Number of Households Using Septic Tanks and Estimated Septic Tank Loading within each WBID Boundary

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the number of households with a septic tank, Column 3 lists the septic tank loading.

WBID	# Households Using Septic Tanks	Septic Tanks (counts/day)
3270	236	5.1×10^{10}
3273	13	2.8×10^{09}
3274	389	8.4×10^{10}
3276	191	4.1×10^{10}
3276A	743	1.6×10^{11}
3277A	1,409	1.3×10^{11}
3277C	624	1.3×10^{11}
3277E	573	1.2×10^{11}
3279	1,457	3.1×10^{11}
3281	1,702	3.7×10^{11}

Table B.5. Estimated Number of Septic Tanks and Septic Tank Failure Rates for Broward County (1998-2009)

This is a six-column table. Column 1 lists the year, Column 2 lists the number of septic tanks newly installed in each year, Column 3 lists the accumulated number of septic tank for each year, Column 4 lists the number of septic tanks repair permit being issued, Column 5 lists the failed septic tank discovery rate, and Column 6 lists the final failure rate.

Year	New installation	Accumulated installation	Repair permit	Failure discovery rate (%)	Failure rate (%)*
1998	208	105,065	1094	1.04	5.21
1999	208	105,273	989	0.94	4.7
2000	202	105,481	903	0.86	4.28
2001	224	105,683	934	0.88	4.42
2002	196	105,907	893	0.84	4.22
2003	151	106,103	799	0.75	3.77
2004	164	106,254	700	0.66	3.29
2005	161	106,418	669	0.63	3.14
2006	195	106,579	500	0.47	2.35
2007	112	106,774	295	0.28	1.38
2008	115	106,886	316	0.3	1.48
2009	55	107,001	333	0.31	1.56
Average	166	106,119	702	0.66	3.32

Wildlife

Wildlife (iguanas, birds, raccoons) is another possible source of fecal coliform bacteria within the WBID boundaries. However, as these represent natural inputs, no reductions are assigned to these sources by this TMDL.

Appendix C: Municipalities Located within each WBID Boundary

Table C.1 lists all municipalities and NPDES municipal separate storm sewer system (MS4) permits covering WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279 and 3281. **Figures C.1a – C.1j** shows all municipalities located within each WBID's boundary.

Table C.1. Municipalities and Municipal Separate Storm Sewer System Permittees by WBID

This is a four-column table. Column 1 lists the WBID number, Column 2 lists the municipality, Column 3 lists the permit number and Column 4 lists the permit name.

WBID	Municipality/Permittee	Permit ID	Permit Name
3270	City of North Lauderdale	FLS000016	Broward County and Co Permittees
	City of Margate	FLS000016	Broward County and Co Permittees
	City of Sunrise	FLS000016	Broward County and Co Permittees
	City of Lauderhill	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	City of Oakland Park	FLS000016	Broward County and Co Permittees
	City of Coral Springs	FLS000016	Broward County and Co Permittees
	City of Coconut Creek	FLS000016	Broward County and Co Permittees
	City of Pompano Beach	FLS000016	Broward County and Co Permittees
	City of Tamarac	FLS000016	Broward County and Co Permittees
	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3273	City of Plantation	FLS000016	Broward County and Co Permittees
	City of Sunrise	FLS000016	Broward County and Co Permittees
	City of Lauderhill	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	City of Oakland Park	FLS000016	Broward County and Co Permittees
	City of Lauderdale Lakes	FLS000016	Broward County and Co Permittees
	City of Tamarac	FLS000016	Broward County and Co Permittees
	City of North Lauderdale	FLS000016	Broward County and Co Permittees
	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3274	Broward County	FLS000016	Broward County and Co Permittees
	City of Oakland Park	FLS000016	Broward County and Co Permittees
	City of Lauderdale Lakes	FLS000016	Broward County and Co Permittees
	City of Tamarac	FLS000016	Broward County and Co Permittees
	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
	City of Wilton Manors	FLS000016	Broward County and Co Permittees
3276	City of Plantation	FLS000016	Broward County and Co Permittees
	City of Sunrise	FLS000016	Broward County and Co Permittees
	City of Lauderhill	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	City of Lauderdale Lakes	FLS000016	Broward County and Co Permittees
	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3276A	City of Plantation	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	City of Lauderhill	FLS000016	Broward County and Co Permittees
	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3277A	City of Plantation	FLS000016	Broward County and Co Permittees
	City of Dania Beach	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	Town of Davie	FLS000016	Broward County and Co Permittees
	City of Hollywood	FLS000020	Broward County and Co Permittees
	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform

3277C	City of Weston	FLS000016	Broward County and co permittees
	City of Plantation	FLS000016	Broward County and Co Permittees
	City of Sunrise	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	Town of Davie	FLS000016	Broward County and Co Permittees
3277E	City of Dania Beach	FLS000016	Broward County and Co Permittees
	Broward County	FLS000016	Broward County and Co Permittees
	Town of Davie	FLS000016	Broward County and Co Permittees
	City of Hollywood	FLS000020	Broward County and Co Permittees
3279	City of Weston	FLS000016	Broward County and co permittees
	Broward County	FLS000016	Broward County and Co Permittees
	Town of Davie	FLS000016	Broward County and Co Permittees
	City of Cooper City	FLS000016	Broward County and Co Permittees
	Town of Southwest Ranches	FLS000016	Broward County and Co Permittees
	City of Sunrise	FLS000016	Broward County and Co Permittees
	City of Pembroke Pines	FLS000016	Broward County and Co Permittees
3281	Broward County	FLS000016	Broward County and Co Permittees
	Town of Davie	FLS000016	Broward County and Co Permittees
	City of Cooper City	FLS000016	Broward County and Co Permittees
	City of Pembroke Pines	FLS000016	Broward County and Co Permittees
	City of Hollywood	FLS000020	Broward County and Co Permittees

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

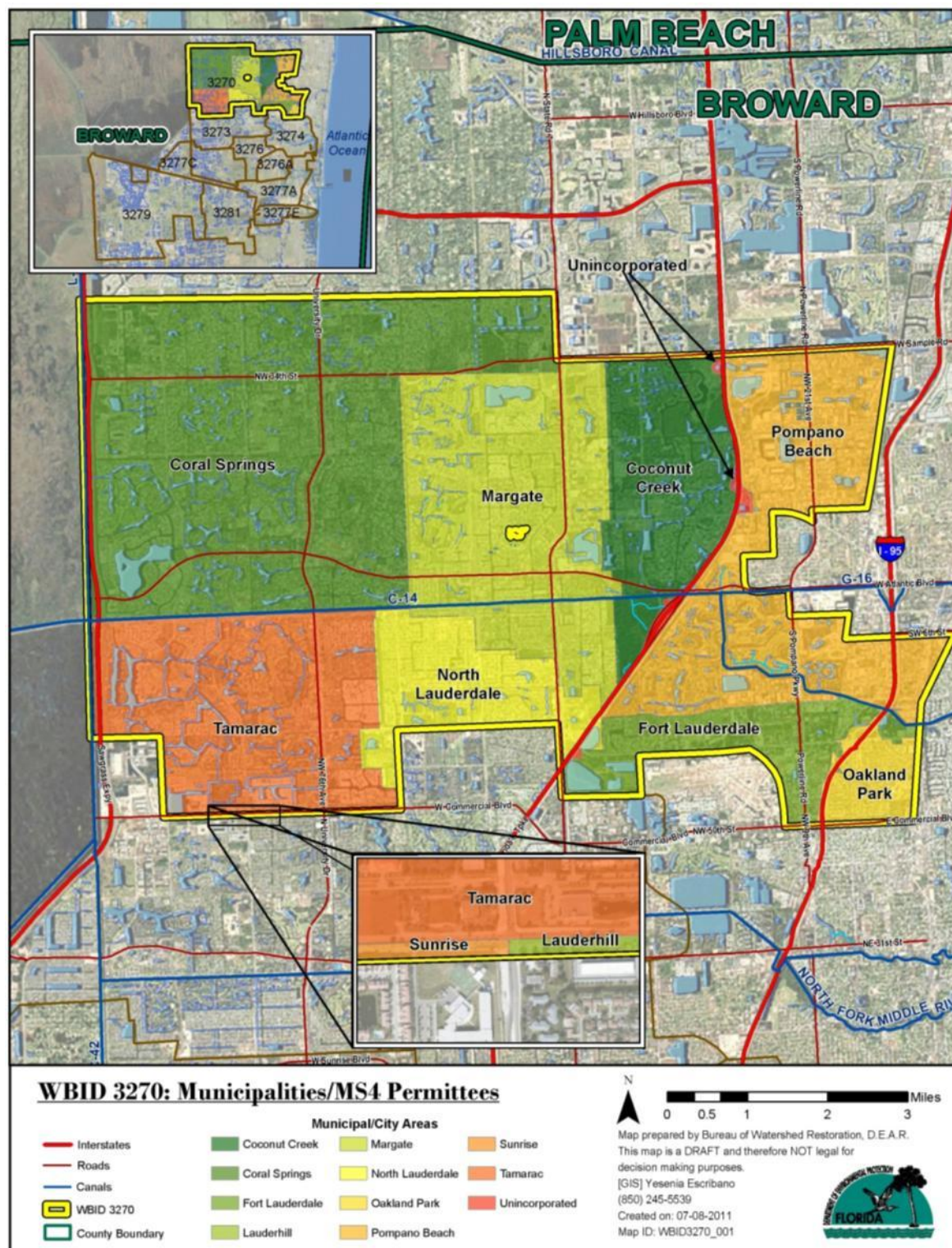


Figure C.1a. Municipalities/Permittees within the C-14 (Cypress Creek) Canal (WBID 3270) Boundary

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

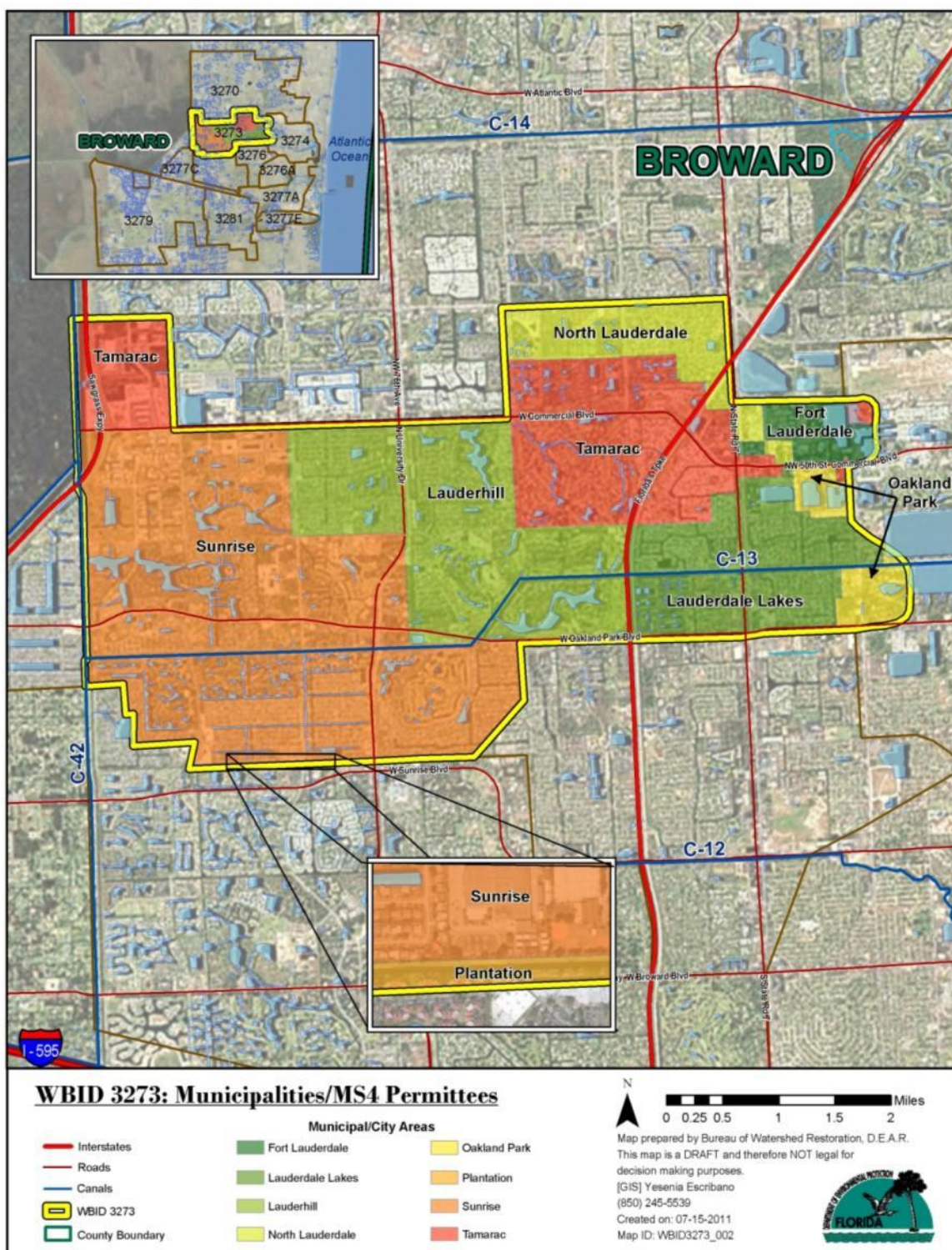


Figure C.1b. Municipalities/Permittees within the C-13 West (Middle River) Canal (WBID 3273) Boundary

DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281), Fecal Coliform

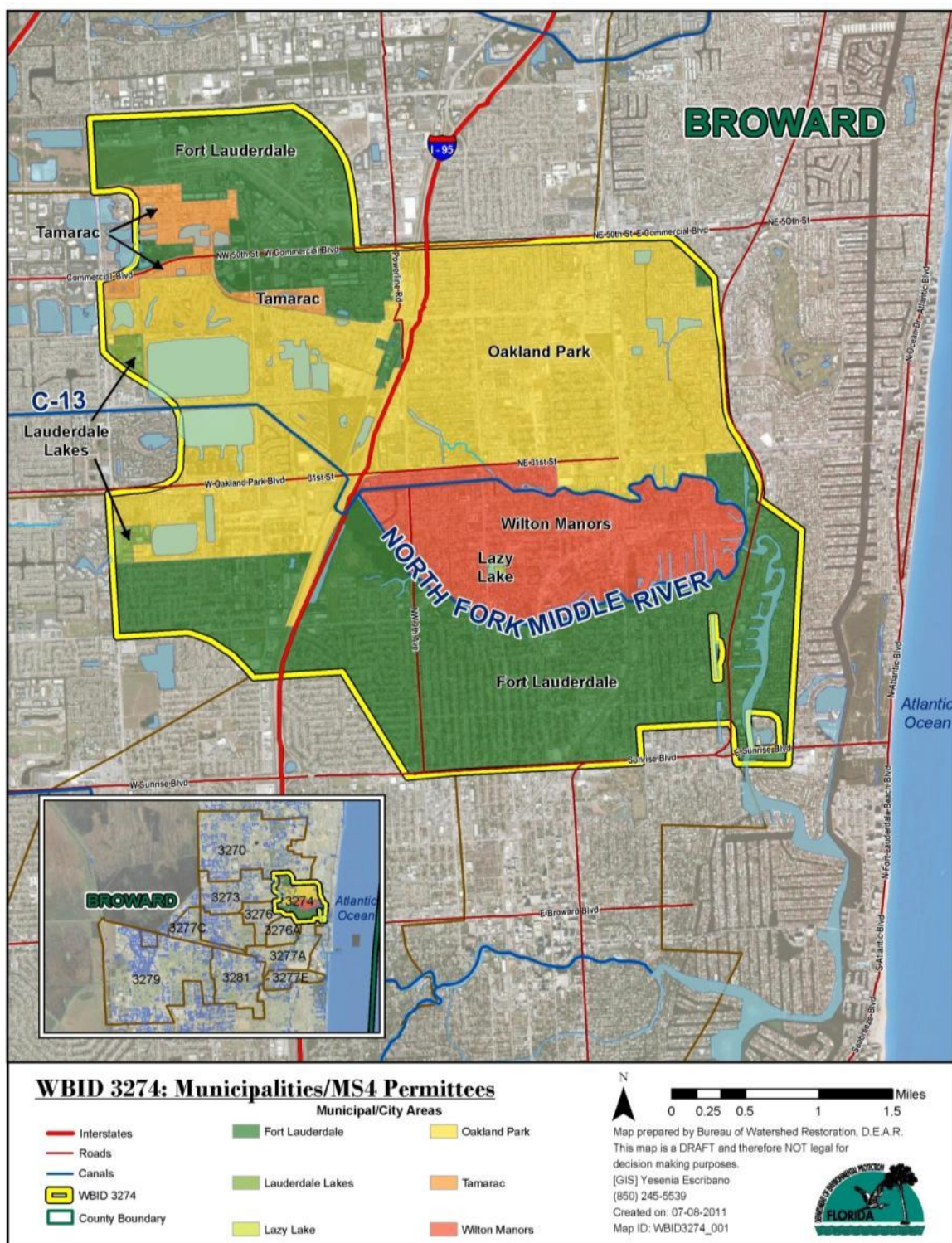


Figure C.1c. Municipalities/Permittees within the C-13 East (Middle River) Canal (WBID 3274) Boundary

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

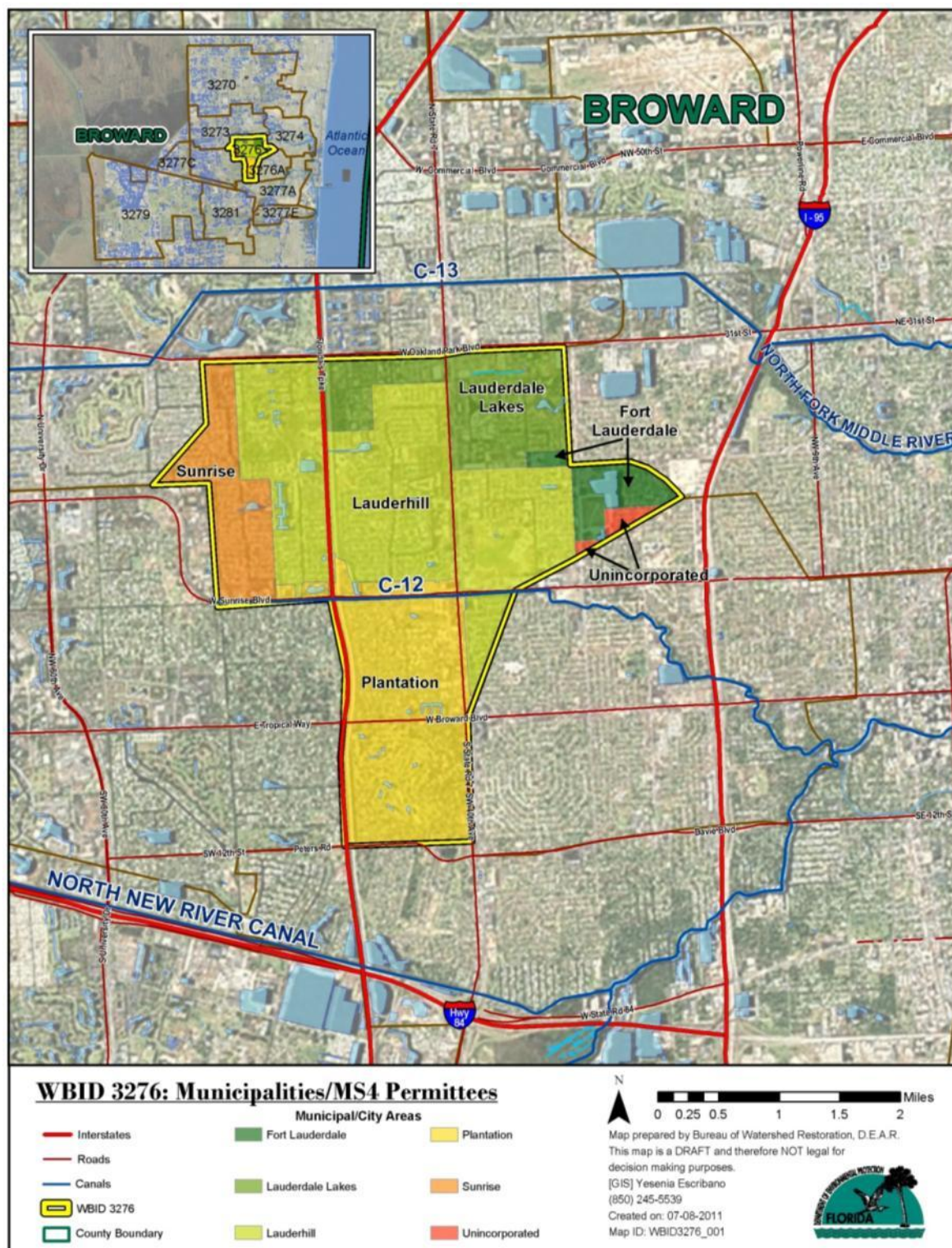


Figure C.1d. Municipalities/Permittees within the C-12 Canal (WBID 3276) Boundary

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

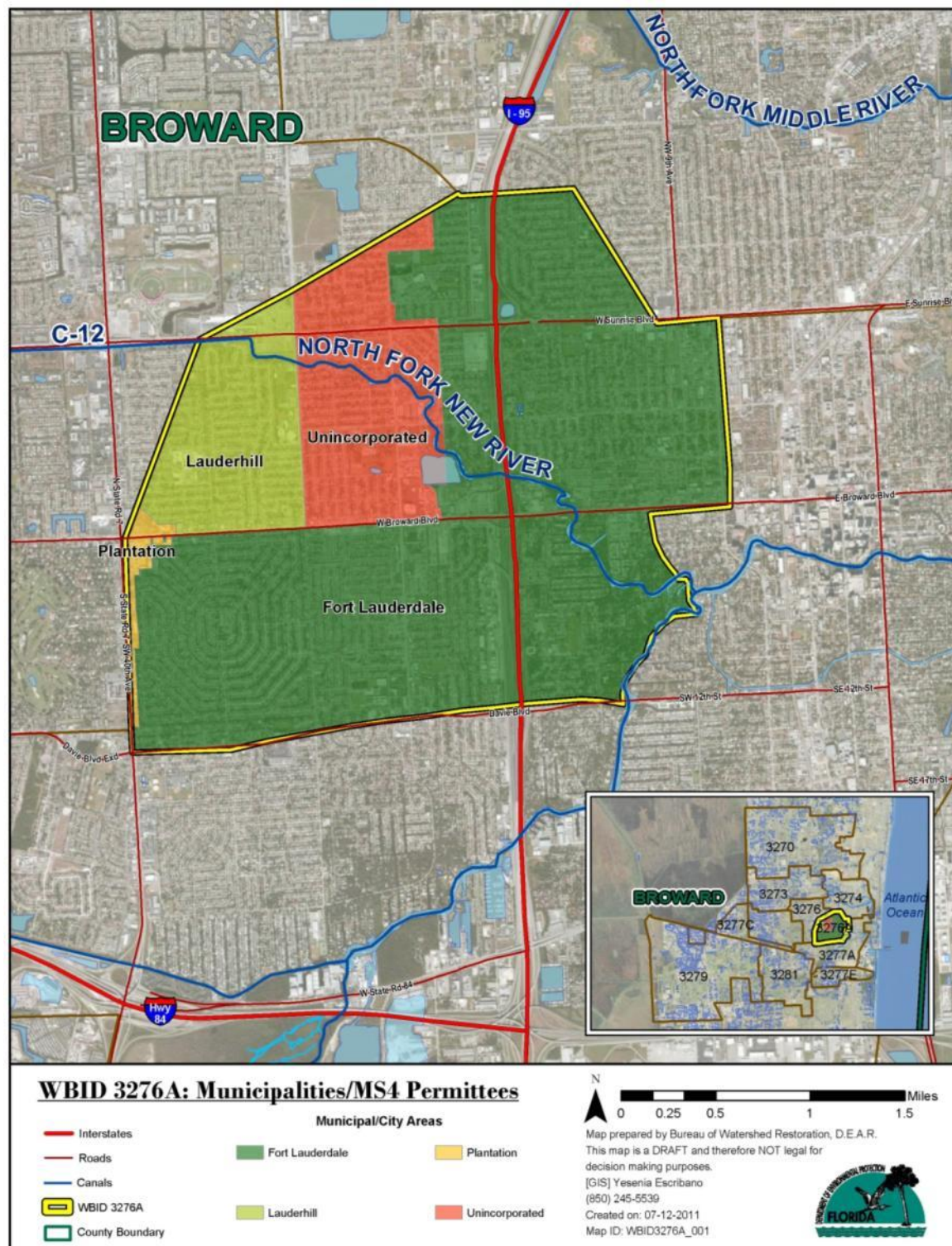


Figure C.1e. Municipalities/Permittees within the New River (North Fork) (WBID 3276A) Boundary

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

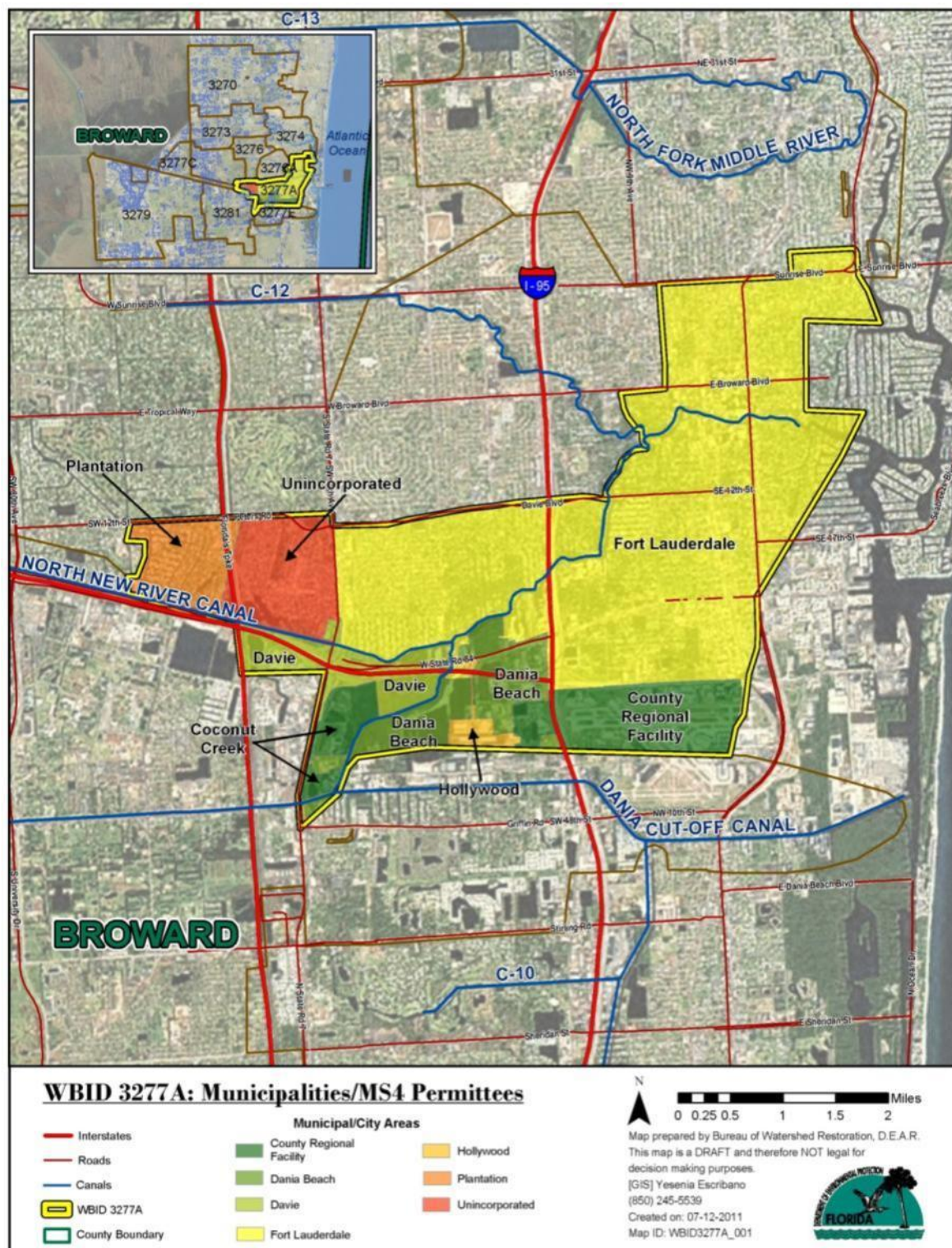


Figure C.1f. Municipalities within the New River Canal (South) (WBID 3277A) Boundary

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

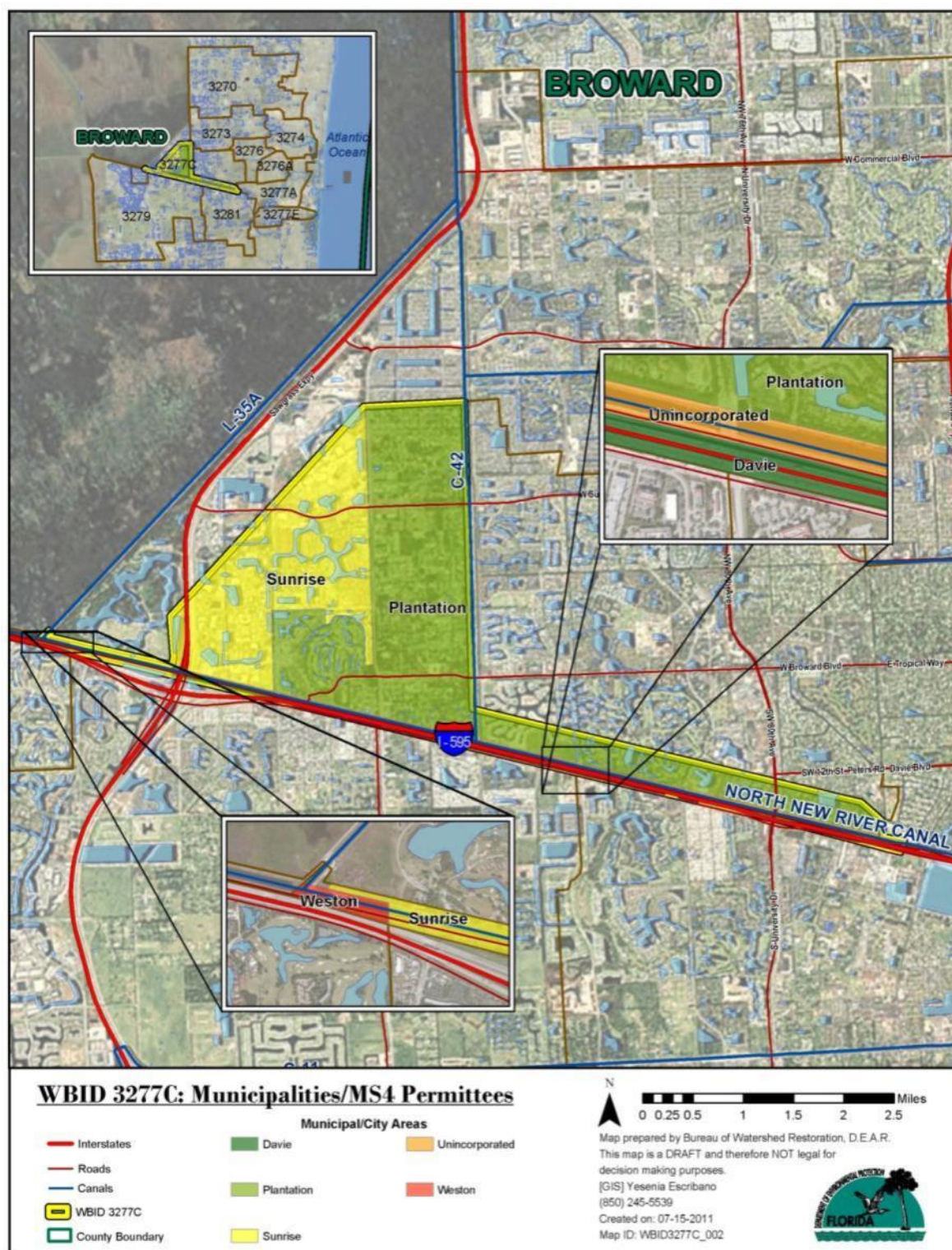


Figure C.1g. Municipalities/Permittees within the North New River Canal (WBID 3277C) Boundary

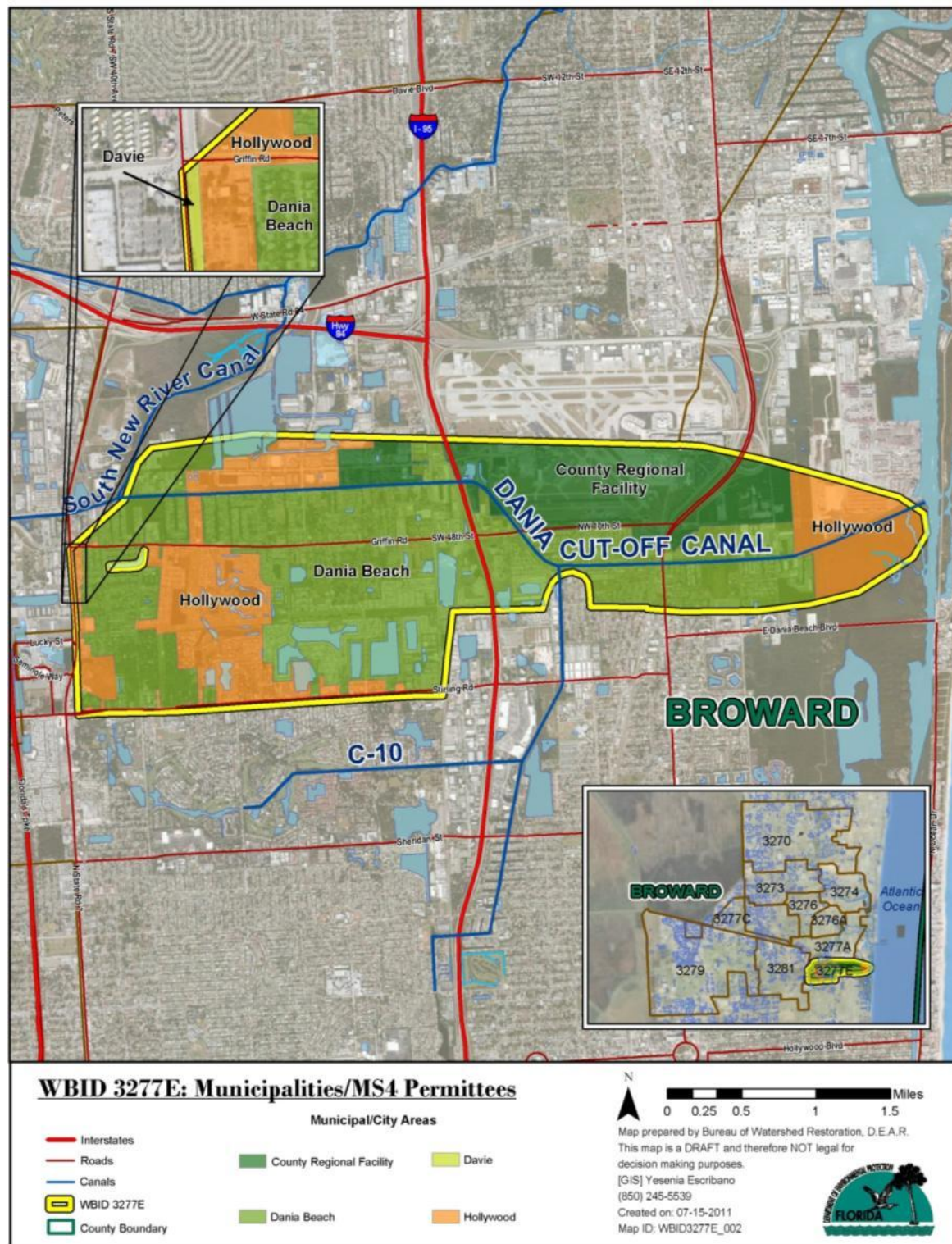
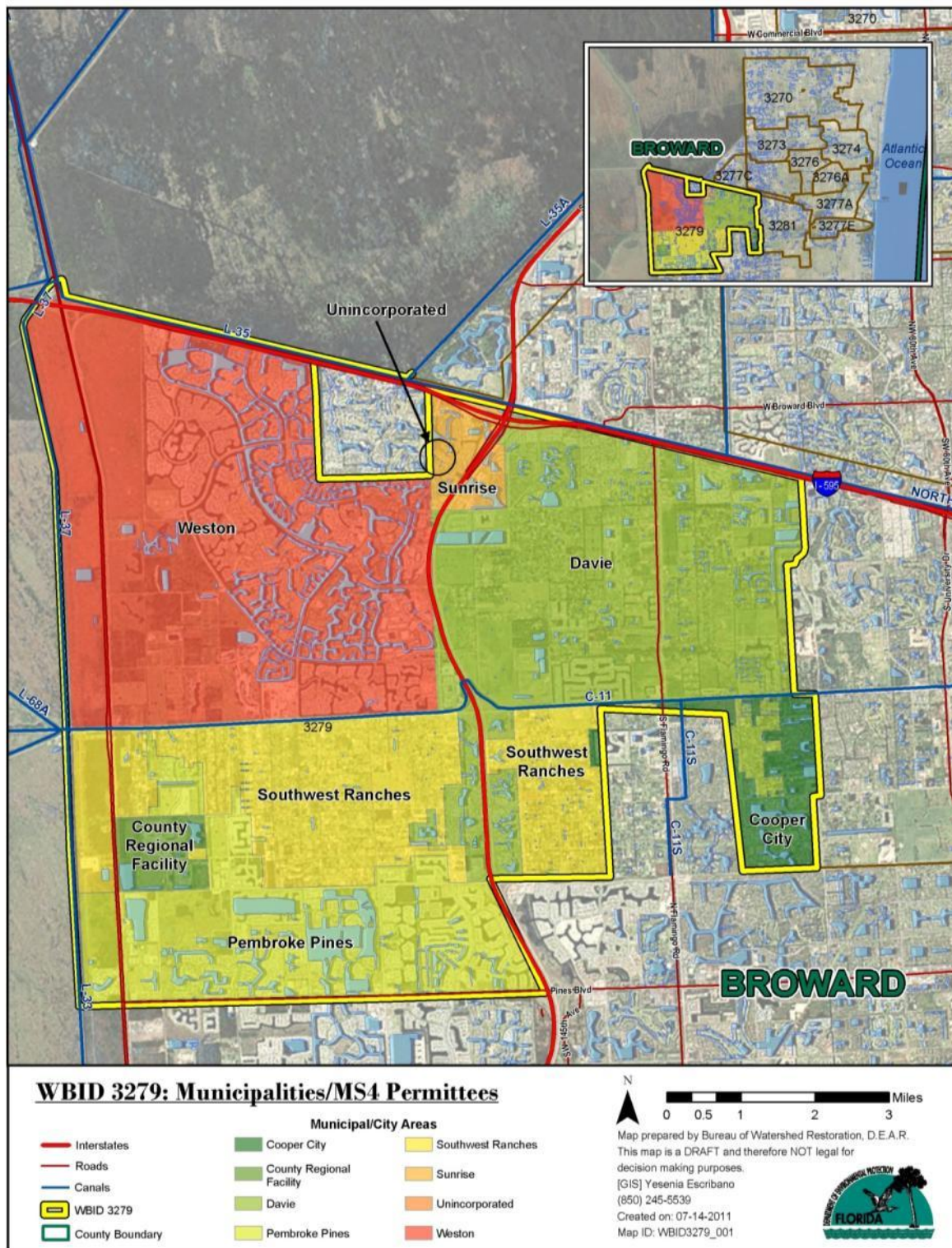


Figure C.1h. Municipalities/Permittees within the Dania Cut-off Canal (WBID 3277E) Boundary



**Figure C.1i. Municipalities/Permittees within the South New River Canal
(C-11) (WBID 3279) Boundary**

**DRAFT TMDL Report: Southeast Coast-Biscayne Bay Basin, C-14 (Cypress Creek Canal) (WBID 3270), C-13 West (Middle River Canal) (WBID 3273), C-13 East (Middle River Canal) (WBID 3274), C-12 (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), New River Canal South (WBID 3279) and C-11 East (WBID 3281),
Fecal Coliform**

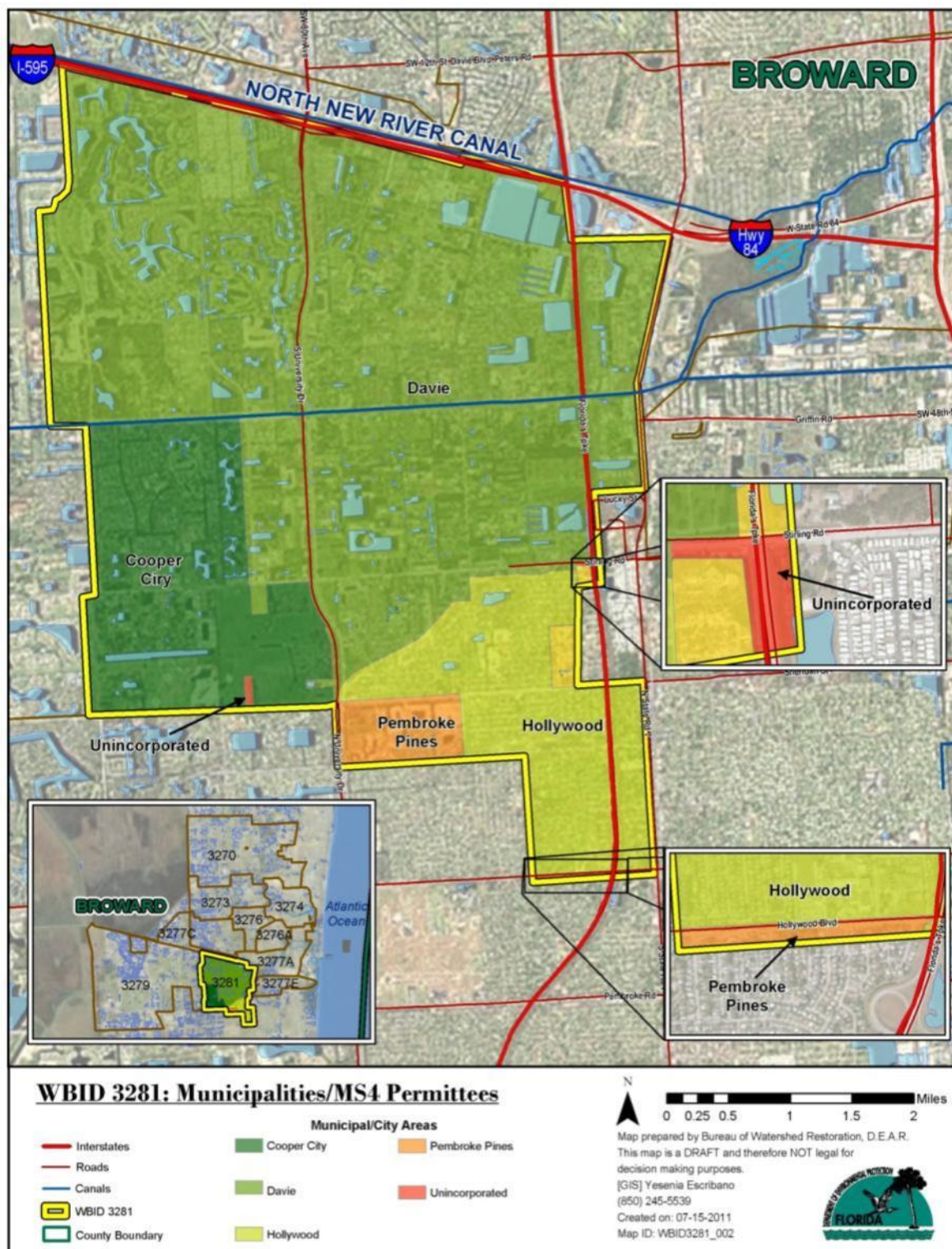


Figure C.1j. Municipalities within the C-11 (East) (WBID 3281) Boundary